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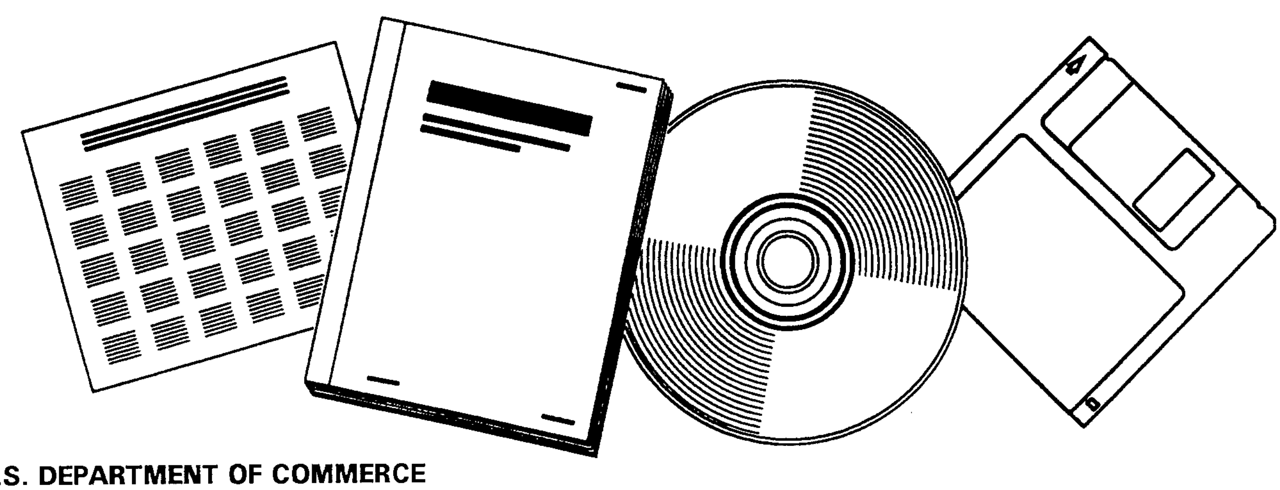
CONSTRUCTION AND COMPARISON OF LOUISIANA'S CONVENTIONAL AND ALTERNATIVE BASE COURSES UNDER ACCELERATED LOADING
INTERIM REPORT

NOV 96



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Construction and Comparison of Louisiana's Conventional and Alternative Base Courses under Accelerated Loading

(Interim Report)

by

William M. King, P.E.
Keith Gillespie
George E. Crosby

LTRC

Louisiana Transportation Research Center

Sponsored Jointly by Louisiana State University and the Louisiana Department of Transportation and Development

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16. Abstract

The Louisiana Transportation Research Center's (LTRC) Pavement Research Facility (PRF) is a permanent, outdoor, full-scale testing laboratory located on a six acre site in Port Allen, Louisiana. The purpose of this facility is to test and quantify full-scale pavement performance of various pavement types under accelerated loading. The loading device which will be used for this first experiment is the Accelerated Loading Facility (ALF).

Construction of the first experimental test site began in April 1995 and was completed by January 1996. The construction of the first experiment consisted of nine test lanes and a parking lane designated for the ALF while not in use. These nine lanes were constructed using alternate base course designs with a common flexible surfacing.

This first experiment is intended to evaluate alternative base construction material and techniques for flexible pavements in Louisiana. This report documents the construction of this first experiment. Research teams from LTRC, LSU, and Louisiana Tech will provide performance evaluations in subsequent reports upon completion of the test program.

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CONSTRUCTION AND COMPARISON OF LOUISIANA'S CONVENTIONAL AND ALTERNATIVE BASE COURSES UNDER ACCELERATED LOADING

Construction Report

by

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LTRC PROJECT NO. 93-1ALF
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Conducted By
LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT,
LOUISIANA TRANSPORTATION RESEARCH CENTER
In Cooperation With
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

November 1996

ABSTRACT

The Louisiana Transportation Research Center's (LTRC) Pavement Research Facility (PRF) is a permanent, outdoor, full-scale testing laboratory located on a six acre site in Port Allen, Louisiana. The purpose of this facility is to test and quantify full-scale pavement performance of various pavement types under accelerated loading. The loading device which will be used for this first experiment is the Accelerated Loading Facility (ALF.)

Construction of the first experimental test site began in April 1995 and was completed by January 1996. The construction of the first experiment consisted of nine test lanes and a parking lane designated for the ALF while not in use. These nine lanes were constructed using alternate base course designs with a common flexible surfacing.

This first experiment is intended to evaluate alternative base construction material/techniques for flexible pavements in Louisiana. This report documents the construction of this first experiment. Research teams from LTRC, LSU, and Louisiana Tech will provide performance evaluations in subsequent reports upon completion of the test program.

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INTRODUCTION

In-place, cement-stabilized select soils have served as the primary base material and construction technique for the majority of non-interstate flexible pavements constructed in Louisiana for many years. Cement stabilized soils offer a base course which is economical and easily constructed, yet provides outstanding structural characteristics. The major factors that hinder the performance of this base type are the potential for non-uniform in-place distribution, proper mixing of the cement and select soils, and the certainty that shrinkage cracking will occur during the hydration process. The cracking of the soil-cement base courses generally results in the cracks reflecting through to the pavement surface, generally Hot Mix Asphaltic Concrete (HMAC) in the form of block cracking. This block cracking provides avenues for moisture to infiltrate the pavement structure and has been documented to be detrimental to the rideability and performance of the pavement. As a result, this type of pavement generally fails prematurely and is unable to carry its design loading.

New Department of Transportation and Development (DOTD) specifications require plant mixing (pug milling) of the soil cement bases in lieu of the traditional in-place stabilized process for Class I base courses. The new requirements will increase the costs associated with construction yet are designed to provide for a more uniformly blended and consistent construction (base) material. It is believed that the effect of uniform blending will lead to less base failures than in-place, cement-stabilized base courses.

The wisdom of incorporating a rigid base material under a flexible pavement surfacing was questioned for many years. Bases which are less stiff (aggregate or relatively weaker soil cement) may offer improved performance characteristics, however, additional base thickness may be required.

This construction report will document all facets of construction for each of the nine test lanes to be tested in the first experiment at the Pavement Research Facility (PRF).

OBJECTIVE

The objective of this study is to evaluate a limited number of alternative base materials and construction techniques that are envisioned to provide a significant reduction in the occurrence and intensity of shrinkage and reflective cracking as manifested by cement stabilized soils (experienced under the old and anticipated under the new specifications) constructed in Louisiana. Alternative designs must be effective in reducing the occurrence and intensity of shrinkage and reflective block cracking without a significant reduction in structural capacity, or they must increase the life-cycle costs prior to being considered for specification by DOTD.

SCOPE

The scope of this research report consists of constructing nine separate test sections and a parking lane on a previously constructed embankment. The test sections were constructed utilizing currently specified base types along with experimental base materials, designs, and construction methods. The completed sections will be tested for failure rates utilizing Louisiana's Accelerated Loading Facility (ALF).

The construction, testing and evaluation of the nine test sections will be conducted in three unique but relatable phases. Phase I will compare the use of a stone with three different base course techniques. The plant mix or pug mill method will be compared in Phase II with three different techniques. Also, phase III will compare the use of in-place, cement-stabilized base courses with three different techniques.

METHODOLOGY

The Louisiana Transportation Research Center's (LTRC) PRF is a permanent, outdoor, full scale testing laboratory purchased by and for the DOTD and is located on a six acre site in Port Allen, Louisiana. The purpose of this facility is to test and quantify full-scale pavement performance of various pavement types under accelerated loading. The device which will be used for this experiment is the ALF.

The contract for construction was advertised during the summer of 1994. Bids were opened August 10, 1994 with the only bidder being Barber Brothers Contracting Co., Inc. of Baton Rouge, Louisiana. Their bid was $250,370.00 which exceeded the estimate by 50 percent; Reviewing the bid and securing additional funding delayed acceptance of the bid approximately six months. The contract was awarded to Barber Brothers Construction Company and work started April 3, 1995 and was completed January 5, 1996. The contract specifications are found in appendix A: Contract Specifications.

Normal construction practices were followed so the project would be as representative as possible of actual highway practices and would be in accordance with *Louisiana Standard Specifications for Roads and Bridges [1].*

Construction by Marchand Construction Co. began on the a five foot embankment in April 1994 and was completed in August 1994. Barber Brothers, Inc. began construction of each test lane for the first experiment on April 3, 1995. Figure 1 shows the site plan for the entire PRF facility, and figure 2 shows the layout and makeup of each test lane. Each phase grouped the types of materials and construction techniques used to construct the test lanes. The contractor bladed and leveled the existing embankment by removing grass clumps and filling low areas. The existing surface was scarified with a ripper blade on a dozer followed by leveling and shaping by a motor grader. A steel-wheeled roller was used to compact the surface to required elevation according to an erected string-line. Table 1 shows the nuclear density and moisture tests that were performed on the embankment to insure adequate compaction.

After achieving the required embankment grade and elevation on lanes 002, 003 and 004, the contractor placed select A-4 soil for the bases according to plans and specifications. The soil material for the base was obtained from the Riverside Materials dredge pits along the Mississippi River near Geismar. The select material was spread by trucks on the prepared embankment. Initially a Barber Green SP 140 Matmaker asphalt spreader was

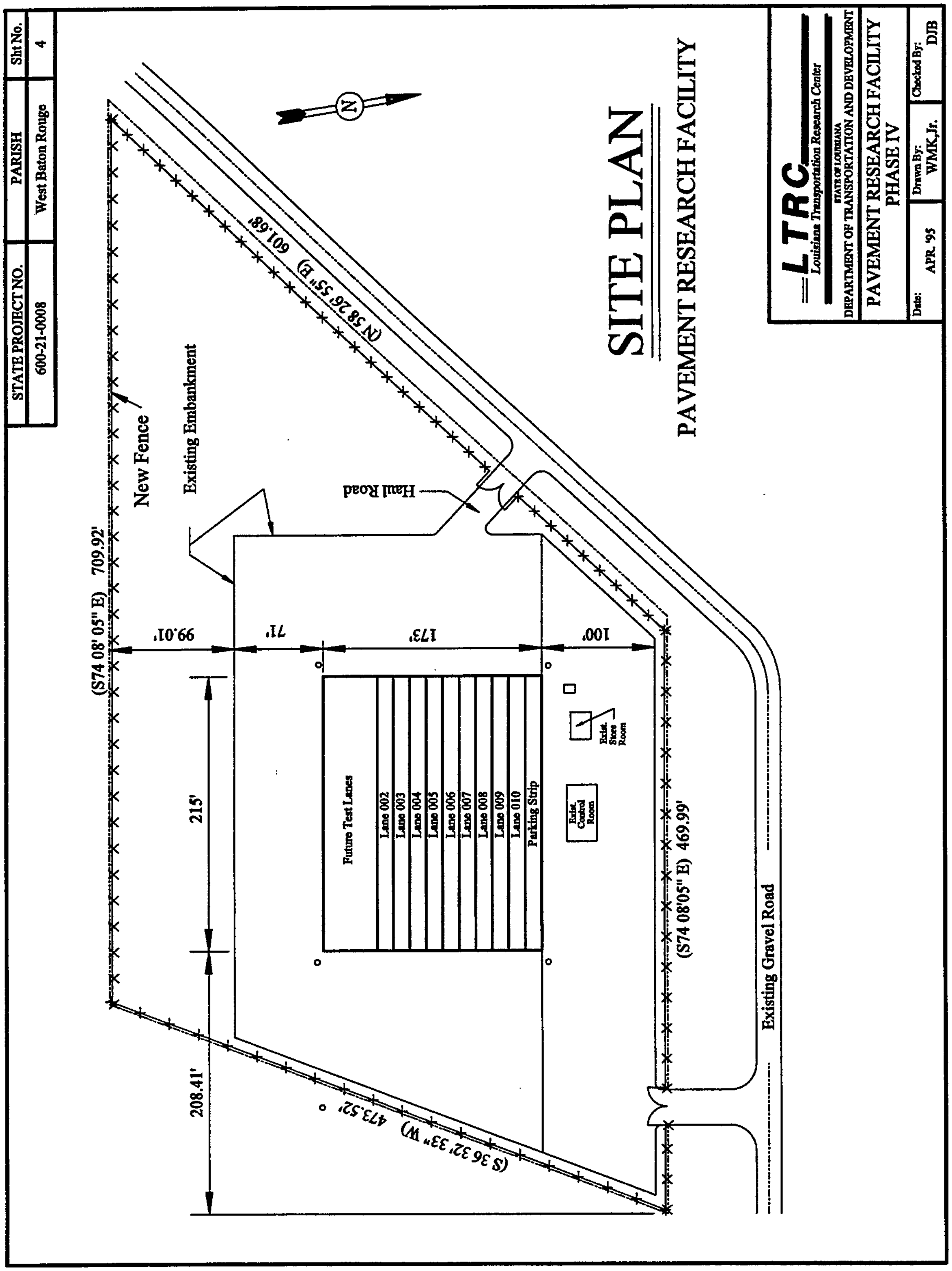


Figure 1

Site plan for the pavement research facility

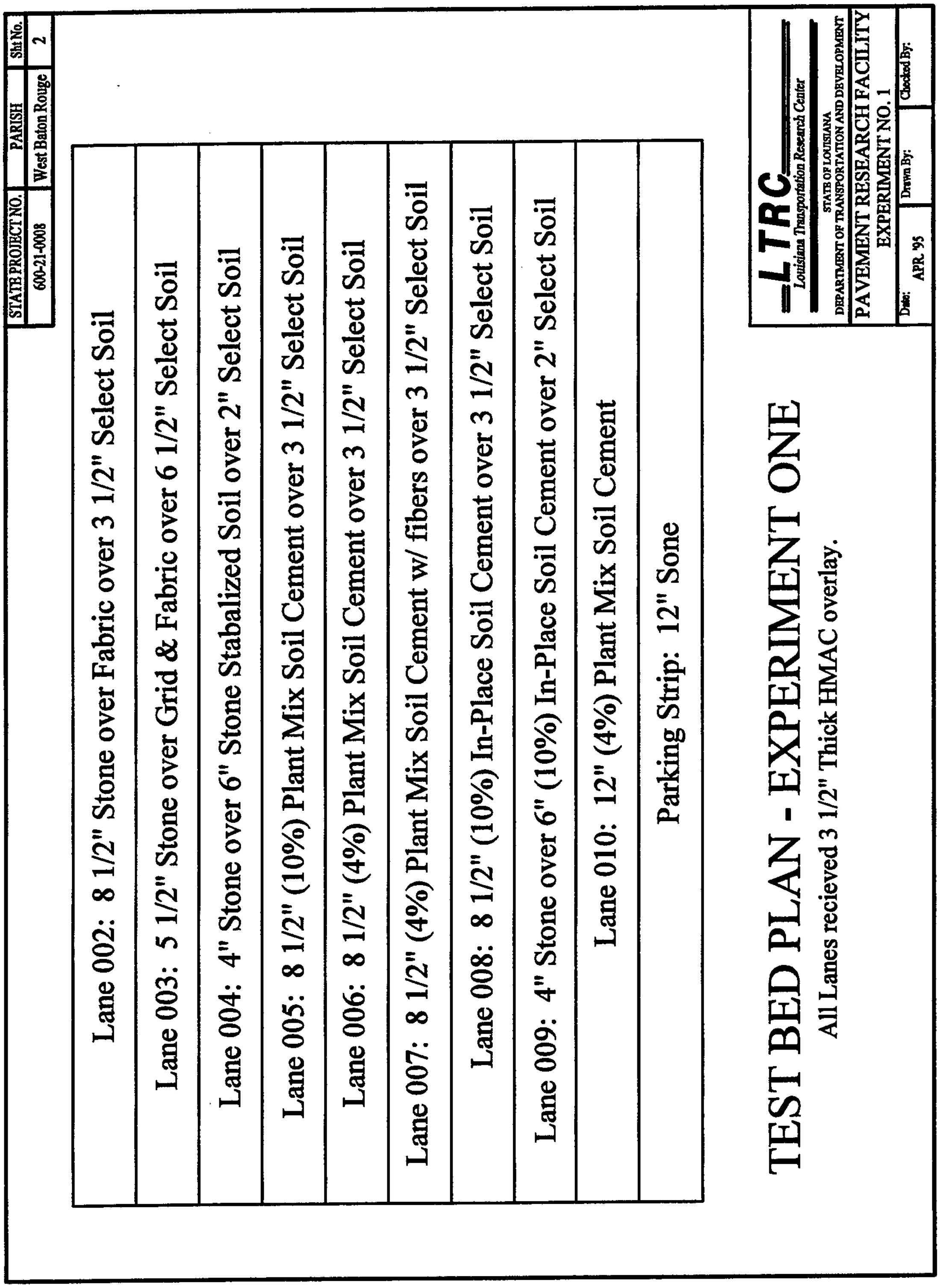


Figure 2

Test bed layout for first experiment

Table 1
Nuclear Density Values of the Embankment

Lane	Station	Embankment Material	Density (Lb/ft^3)	Moisture Content (%)
S-002	0+58	A-4	106.8	17.9
S-002	1+07	A-4	107.7	16.3
S-002	1+58	A-4	104.8	16.1
S-003	0+58	A-4	106.3	15.9
S-003	1+07	A-4	107.8	15.9
S-003	1+58	A-4	107.7	16.3
S-004	0+58	A-4	106.0	17.4
S-004	1+07	A-4	103.8	18.6
S-004	1+58	A-4	104.3	16.3
S-005	0+58	A-4	107.7	16.6
S-005	1+07	A-4	104.4	18.0
S-005	1+58	A-4	105.9	15.1
S-006	0+58	A-4	106.5	16.4
S-006	1+07	A-4	106.5	15.5
S-006	1+58	A-4	108.5	14.8
S-007	0+58	A-4	108.2	13.5
S-007	1+07	A-4	107.9	14.6
S-007	1+58	A-4	108.4	14.1
S-008	0+58	A-4	108.3	16.7
S-008	1+07	A-4	105.0	16.6
S-008	1+58	A-4	107.3	14.1
S-009	0+58	A-4	104.6	14.4
S-009	1+07	A-4	107.6	16.6
S-009	1+58	A-4	109.0	11.8
S-010	0+58	A-4	108.6	14.1
S-010	1+07	A-4	109.6	15.3
S-010	1+07	A-4	106.9	13.0
S-010	1+58	A-4	106.5	15.5

used to spread the select soil but this method was discontinued and spreading was accomplished by truck tailgate distribution and blading by a Case 850 dozer. Compaction was obtained using a Dynapac roller along with a pneumatic-tired roller, and grade was achieved using a Caterpillar TR 225B trimmer controlled by erected string-lines to trim the compacted select soil to proper grade and required 3½ inch (8.9 cm) thickness. Table 2 shows the density and moisture content for the select soil placed in each of the test lanes specified. A single layer of class C geotextile fabric (Amoco class C, MOD 4551) was placed on the compacted select soil according to specifications.

Lane 003 was constructed using the same procedure and equipment as lane 002 with the select soil base constructed to 6½ inch (16.5 cm) thickness. A single layer of engineering grid [(Tensar Biaxial BX-1100) (SS-1)] was placed on the compacted subgrade followed by a single layer of geotextile fabric (Amoco class S, Style 2002).

Lane 004 was constructed by placing a 6¼ inch (15.9 cm) compacted layer of select soil on the prepared subgrade in the same manner as the previous lanes. A 2¼ inch (5.7 cm) loose layer of crushed stone was placed on the compacted select soil and mixed in-place to a depth of 6½ inches (16.5 cm) utilizing a Raygo stabilizer. The stone-soil mixture was compacted with a Dynapac roller and trimmed utilizing the Caterpillar TR 225B trimmer. Table 3 shows the gradation of the stone used and stockpiled at the PRF site.

As work progressed on lanes 002, 003, and 004, the contractor was allowed to place and compact the required thicknesses of select soil on the remainder of the test lanes. Construction also started on the installation of the formed blockouts to provide an access area for instrumentation wiring to be installed by test facility personnel. The blockouts consisted of wooden 2-by 12 inch (5.1 cm by 30.5 cm) forms constructed to provide an open-topped 2-by 50-foot (.6 m by 15.2 m) rectangular box and were placed between lanes 003 and 004, 005 and 006, 007 and 008, 009 and 010 with a single-faced blockout adjacent to lane 002. The forms were erected, braced and filled with stone and compacted as installation of instrumentation wiring allowed. The blockouts were temporarily covered by plywood to prevent rain from penetrating the subgrade during construction. Installation of gauges in all lanes continued according to gauge layout plans not covered in the construction report.

Table 2
Nuclear Density Values of Select Soil

Lane	Station	Soil	Density (Lb/ft^3)	Moisture Content (%)
S-002	0+58	A-4	108.9	10.3
S-002	1+07	A-4	108.2	12.0
S-002	1+58	A-4	107.6	11.5
S-003	0+58	A-4	105.7	12.2
S-003	1+07	A-4	109.5	12.9
S-003	1+58	A-4	105.6	13.9
S-004	0+58	A-4	106.7	11.7
S-004	1+07	A-4	104.9	11.9
S-004	1+58	A-4	106.9	12.3
S-005	0+58	A-4	104.0	11.5
S-005	1+07	A-4	104.3	11.4
S-005	1+58	A-4	109.0	9.7
S-006	0+58	A-4	103.9	10.0
S-006	1+07	A-4	104.5	11.7
S-006	1+58	A-4	103.7	10.9
S-007	0+58	A-4	104.8	14.8
S-007	1+07	A-4	109.1	13.9
S-007	1+58	A-4	107.7	13.6
S-008	0+58	A-4	110.5	15.5
S-008	1+07	A-4	112.5	12.0
S-008	1+58	A-4	112.9	13.9
S-009	0+58	A-4	108.3	14.2
S-009	1+07	A-4	108.9	14.4
S-009	1+58	A-4	108.4	13.3

TABLE 3

Stone Gradation

SIEVE SIZE	SPECIFIED % PASSING	ACTUAL % PASSING
1½"	100	100
1"	90-100	94.87
¾"	70-100	79.65
No. 4	35-65	23.29
No. 40	12-32	4.64
No. 200	5-12	1.49

Stone for lanes 002, 003, 004, and 001 (the parking lane) was placed by back dumping from trucks and was spread using a Case 850 dozer and a small motor grader. Compaction of the stone layers was achieved by using a Dynapack roller and a pneumatic roller. Flooding and rolling was used as a compaction aid on the stone sections of lanes 002 and 003. Table 4 shows the density and moisture content of the stone layers placed in each of the test lanes specified. After final compacting, an asphaltic curing spray was placed on the three stone layers.

Select material for lanes 005, 006, 007, and 009 was compacted and trimmed in preparation for the plant-mixed, soil cement construction. The contractor elected to use the mixer at the asphalt plant to process the required mix. Calibration tests were run at the plant utilizing the A-4 select soil, cement, and fibrillated propylene fibers (Fibergrids™) scheduled for inclusion in the soil-cement on lane 007. Following approval of the contractor's plant-mixing operation, placement began on the soil-cement mixtures on the previously prepared base.

The material was delivered to the site by covered trucks and spread uniformly over the base. Spreading was accomplished by a Case 850e dozer and a small motor grader.

Moisture and density tests were taken for each truckload of material to ensure uniformity in accordance with the specifications.

Compaction was obtained using a sheeps-foot roller and a pneumatic roller. Material for lane 010 was placed in two, six inch thick layers of plant-mixed soil cement to make up the 12 inch (30.5 cm) thick base. The top layer was placed immediately after the bottom layer and compaction was accomplished using a sheeps-foot roller.

TABLE 4

Nuclear Density Values of Limestone Base

Lane	Station	Material	Thickness	Density (Lb/Ft^3)	Moisture Content (%)
S-002	0+58	LIMESTONE	8.5"	137.2	4.0
S-002	1+10	LIMESTONE	8.5"	139.0	3.6
S-002	1+57	LIMESTONE	8.5"	138.4	5.1
S-003	0+58	LIMESTONE	5.5"	138.1	3.8
S-003	1+07	LIMESTONE	5.5"	136.6	4.4
S-003	1+58	LIMESTONE	5.5"	137.4	4.6
S-004	0+58	LIMESTONE	4"	137.3	4.4
S-004	1+07	LIMESTONE	4"	136.8	5.5
S-004	1+58	LIMESTONE	4"	137.6	5.2

Final grades were obtained by trimming with the Caterpillar TR 225B trimmer followed immediately by final rolling with a Dynapac roller. After final compaction, an asphaltic curing membrane was hand-sprayed over the surface according to specifications.

The contractor continued placing A-4 select soil on lanes 008 and 009 in preparation for the construction of the in-place, soil-cement on the two test lanes. Cement was delivered to the project in covered trucks and spread over the test lanes by a calibrated mechanical spreader. A Caterpillar SS 250 stabilizer was used to process the soil cement for the 8½ inch (21.6 cm) layer in lane S-008 and for the six inch (15.2 cm) layer for lane S-009. Initial compaction was accomplished by a sheeps-foot roller followed by a Dynapac roller and shaped by a small motor grader. Table 5 shows the density and moisture content for soil-cement stabilized and soil-mixed base materials for each of the test lanes specified. Final grades were obtained by using a Caterpillar TR 225B trimmer followed by final rolling with a Dynapac roller. An asphaltic curing membrane was hand sprayed over the final surfaces. Four inches of stone was placed, compacted and cured over the cured soil cement layer on lane 009. Table 6 shows the compressive strength for the soil-cement test lanes.

The installation of gauges and wiring for instrumentation (see section 6.0: Instrumentation) took place concurrently with lane construction of all wiring routed to the block-out areas and to the metal junction boxes. The boxes were fabricated out of steel plate and were anchored inside the wooden block-outs. A hinged top plate flush with the final surfaces provided access to the gauge wiring. The wiring was bunched and threaded through PVC pipes and placed in the top cover. Elevation readings were made on top of all gauges (appendix B: Instrumentation). Also, final elevations of the HMAC surfacing were made at all gauge locations and are in the project file. Work was completed on all base courses by May 31, 1995.

Appendix C contains selected photographs of the construction, installation of the instrumentation, and the final product.

Table 5
Nuclear Density Values of Soil Cement/Mixed Bases

Lane	Station	Base Material	Thickness	Density (Lb/Ft^3)	Moisture Content (%)
S-004	0+59	35% Soil/65% Stone	6"	119.1	12.4
S-004	1+07	35% Soil/65% Stone	6"	120.9	12.5
S-004	1+58	35% Soil/65% Stone	6"	120.8	10.2
S-005	0+59	10% Plant Mixed S/C	8½"	109.3	16.0
S-005	1+03	10% Plant Mixed S/C	8½"	108.7	13.6
S-005	1+58	10% Plant Mixed S/C	8½"	109.4	15.4
S-006	0+58	4% Plant Mixed S/C	8½"	107.9	11.9
S-006	1+07	4% Plant Mixed S/C	8½"	106.8	11.0
S-006	1+57	4% Plant Mixed S/C	8½"	106.4	12.6
S-007	0+58	4% Plant Mixed S/C, w/ Synthetic Fibers	8½"	106.6	8.5
S-007	1+07	4% Plant Mixed S/C, w/ Synthetic Fibers	8½"	107.9	10.2
S-007	1+58	4% Plant Mixed S/C, w/ Synthetic Fibers	8½"	108.7	8.9
S-008	0+58	10% In-Place Mixed S/C	8½"	108.0	13.6
S-008	1+07	10% In-Place Mixed S/C	8½"	106.6	13.8
S-008	1+58	10% In-Place Mixed S/C	8½"	107.9	12.7
S-009	0+57	Stone Base	4"	136.6	3.9
S-009	1+07	Stone Base	4"	136.8	3.3
S-009	1+58	Stone Base	4"	138.9	3.6
S-009	0+58	In-Place Mixed S/C	8½"	106.0	16.6
S-009	1+07	In-Place Mixed S/C	8½"	106.7	15.3
S-009	1+58	In-Place Mixed S/C	8½"	109.5	14.6
S-010	0+58	4% Plant Mixed S/C	12"	107.4	16.5
S-010	1+07	4% Plant Mixed S/C	12"	106.2	11.6
S-010	1+58	4% Plant Mixed S/C	12"	No Data	No Data

Table 6
Compressive Strength for Soil Cement

LANE NO.	AVERAGE COMPRESSIVE STRENGTHS, PSI					
	7 Day Cure, 100% Compaction	28 Day Cure, 100% Compaction	56 Day Cure, 100% Compaction	7 Day Cure, 95% Compaction	28 Day Cure, 95% Compaction	56 Day Cure, 95% Compaction
S-005	278.9	362.8	472.6		280.0	304.6
S-006	111.0	162.6	147.7		85.9	135.0
S-007	139.6	178.4	220.1		127.3	157.9
S-008	242.5	336.3		142.5	206.8	
S-009	340.6	435.2		213.4	296.6	
S-010	141.8	195.9	220.5		113.4	139.4

HMAC asphaltic surfacing

The HMAC was required to be both consistent between lanes and representative of Louisiana's high traffic, high stability, "Type 8" mixtures as defined by *Louisiana's Standard Specifications for Roads and Bridges [1]*. A two inch (5.1 cm) binder course and 1½ inch (3.8 cm) wearing course was required by the plans.

In May 1995, the contractor proposed a job mix formula typical of the traditional Type 8 gravel designs of locally available fine aggregate. The gradation followed the 0.45 power curve, forcing an extremely dense gradation. This mixture, although within specification, was rejected due to test results from the Corp of Engineers Gyratory Testing Machine (GTM). The mix exhibited a Gyratory Shear Index (GSI) of over 1.1, indicating rut susceptibility.

A new job mix formula that would show improvement on the GTM was requested. The contractor proposed a mix with 11 percent Arkansas granite fines; 65 percent C-1, a ½ inch (1.3 cm) nominal size crushed gravel; and 19 percent C-2, a 1/4 inch (.7 cm) intermediate sized crushed gravel and 15 percent coarse sand. The optimum asphalt cement content fell by 0.2 percent from 5.5 percent to 5.3 percent. The GSI measured 0.99, indicating a stable mixture. The asphalt cement was required to meet PAC40-HG specifications and was supplied by Koch Materials. Table 7 shows the HMAC mix properties, which were the same for both the Binder and Wearing Course mixture.

Trial mix dates in July, August, September, and October provided ample preliminary data that pointed to some problems with the plant. The screens would easily overfill in the old Barber Green Batch plant causing segregation. Plant changes were requested prior to the start of construction. Some of this trial mix was allowed on the parking areas of the Pavement Research Facility. The contractor made the decision to remove the screens and make the necessary plant modifications to operate as a screen-less batch facility. Also, a cover for the stockpile of granite fines was requested as they were to be fed directly into the Hot Bin. These changes proved sufficient and placement of the Asphaltic Surfacing was re-scheduled.

The contractor first moved on-site September 6, 1995. The asphalt was delivered from the contractor's Essen Lane plant in Baton Rouge from a pre-tested silo. Paving began on the parking area. The contractor used a Cedar Rapids-461 Greyhound paver and operated from erected stringlines. Paving was discontinued when plant problems described above arose. Work was delayed until November 9, 1995.

Finally on November 10, 1995, the test bed surface was broomed and sprayed with a light application of asphalt tack coat. Lay-down for the two inch (5.1 cm) Binder Course was completed in one day. Compaction of the asphalt was accomplished by a Caterpillar CB-534 B, 12 Ton vibratory steel wheel roller. A BOMAG pneumatic tired roller was used for the finish rolling.

The contractor placed the final 1½ inch Wearing Course on November 22, 1995 after another light application of tack coat. Again 100 tons of mix was prepared and silo stored until initial test data such as gradation and percent voids could be used for verification. The haul time from the plant to the job site was about 30 minutes, and the mix temperature at the paver measured approximately 290 degrees Fahrenheit. The plant voids were higher than design, but the difference was not sufficient to warrant a rejection of the mixture.

The Binder Course and Wearing Course were divided into individual lots for control purposes. Marshall Volumetric Quality Control and Assurance was performed at the plant as is typical for all Louisiana asphalt mixes. In addition, LTRC tested one sample per truck with the GTM and performed extractions for AC Content and gradation to verify the mixture shown in table 7.

Table 7
HMAC Mix Properties

Job Mix Formula	% Passing		
Sieve Size	Design Data	Ave. Binder Data	Ave. Wearing Data
3/4"	100	100	100
1/2"	98	99	99
3/8"	85	90	91
No.4	63	60	63
No. 10	41	40	43
No. 40	23	22	24
No. 80	13	9	12
No. 200	5.2	5.1	5.9
Theo. Gravity	2.434		
%AC	5.3	5.2	5.1
VFA	16.5	17.5	16.8
VMA	75	68	71
%Voids	4.5	5.3	4.8
Marshall Stability	2200	1870	2300
Flow	11	9	10
In-Place Density,(Lb/ Cu. Ft.)	145	138	137
GSI	0.99	1.00	0.98

Instrumentation

Each test lane was instrumented with strain measuring and pressure gauge devices, which were placed at various layer interfaces with vertical deflection devices retrofitted. A weather station was also installed at the PRF with temperature measuring devices placed at various depths of the HMAC in both a shaded and unshaded area.

Strain gauges. The overall purpose of the strain gauges was to measure the horizontal strains in the asphalt, asphalt/base interface, and base/subbases interface. Also, another purpose was to compare the installation processes relative to the type of gauge and gauge cost.

A total of 196 Micro-Measurements CEA-06250UN-120 general purpose gauges were placed through`out the nine test lanes. They are 120 Ω gauges, with a gauge factor of 2.085, measuring 0.5-by 0.2 inches (1.3-by 0.5 cm). The cost of the gauges was approximately $18.00 for a box of five.

A total of 164 Kyowa KM-120-120-H2-11W20M3 embedment strain gauges were placed throughout the nine test lanes. They are also 120 Ω gauges, with a gauge factor of 2.0, measuring ½-by 4 inches(1.3-by 10.2 cm). The cost of the gauges was approximately $99.00 each.

The location of each individual gauge is detailed in Appendix B: Instrumentation Layout, which also includes the final elevation of each gauge.

Vertical deflection devices. Linear variable differential transformers (LVDT's) were installed to measure the displacements between the (1) top and bottom of the asphalt and (2) top of the asphalt and bottom of the bases. The type of LVDT's used throughout the lanes was the Lucas Schaevitz HPA 050 and HPA 500. These two devices have a linear range of ±0.05 and ±0.5 inches (1.3 and 12.7 cm) respectively. Special brass housings were fabricated to facilitate the calibration and re-calibration of the gauge if the linear range is exceeded.

Pressure cells. The Kulite 0234-4-100 soil stress compression pressure cell was installed to measure the vertical stress distribution three inches below the embankment. The gauge, which is 3 inches (7.6 cm) in diameter, is mounted on a steel plate 6-by 6 inches (15.2-by 15.2 cm) for greater stability. The measuring capability of the gauge is 200 pounds.

Signal conditioning. Analog Devices 3B Series signal conditioning modules and rack system was used to provide the necessary excitation for the various instrumentation. This system also provided amplification, completion, filtering, protection, and cold junction compensation. Two signal conditioning racks each houseing 16 conditioning modules and a single power supply unit, are housed inside a 24-by 48 inch (61-by 121.9 cm) fiberglass enclosure. The enclosure also contains two dip boards upon which resistors are placed to form the Wheatstone bridges necessary for strain gauge circuit completion.

Temperature compensation/drift control. Several measurements were taken to protect the data collected from drift associated with temperature variance in the asphalt and instrumentation box. The first method was the three wire, single strain gauge, quarter-bridge configuration. This method of wiring generally reduces wire desensitization by about 50 percent. The second measure taken was the placement of a balancing resistor electrically adjacent to the strain gauge in the Wheatstone bridge. This provided a balancing of the bridge circuit prior to testing.

Cabling. A cable consisting of Teflon insulated individual conductors, surrounded by an aluminum-braided shield, overlaid with an external Teflon jacket was used with the Micro-Measurements gauges. The Kyowa gauges were manufactured with Teflon jacketed individual conductors. The cable used to carry the amplified/conditioned signal from the instrumentation box to the PC was a PVC insulated, nineteen pair, individually shielded cable.

Instrumentation data acquisition system

Hardware. A data acquisition board manufactured by Microstar Laboratories was chosen for use in the collecting, digitizing and transfer of data from gauges to the PC. The model used is the Dap 3000a/212 along with the MSXB 018-01 analog expansion board. The data acquisition board features an on-board 486 processor and runs in a 32-bit operating system. Other features include: 16 analog inputs expandable to 512 analog inputs, -10 to +10 volt inputs, up to 769K samples/second, 2K on-board RAM, and control via Dapl software that may be used with other data acquisition software.

Software. The software used is manufactured by Laboratory Technologies Corp. The version currently used is LABTECH NOTEBOOKpro version 9, for Windows 95. This system offers preemptive multitasking, protected virtual memory, and executes applications in a multi-threaded environment. The benefits are that LABTECH 1) can either be graphically programmed from a menu driven picture screen or a fill-in-the-blank question and answer menu, 2) can be set up in stage/duration for start-stop-start data acquisition, 3) has built-in drivers to support numerous data acquisition boards, and 4) its very easy to understand and build very comprehensive functioning programs for data collection and presentation. The cost of this software is about $2295.00

Weather data acquisition

A Campbell Scientific Weather Station was installed at the northeast corner of the test bed to acquire weather data. The weather station is equipped with a CR10 Data Logger

Measurement and Control Module and utilizes PC208 operating software to collect the data. The weather station updates itself every 10 seconds, records the data every hour, and has the following capabilities to record: (1) Temperature measurements from CS model HMP35C probes, (2) Relative Humidity measurements (Maximum and Minimums) from CS model HMP35C probes, (3) wind direction and speeds using Young's model 5103-5/5305-5, (4) solar watts per meter squared, (5) barometric pressure measurements (maximum, minimum, and average) using a model PTA427 probe, and (6) rain fall every hour and it's intensity using a CS model TE525 Tipping bucket rain gauge.

The system is currently using eight temperature thermocouples to measure temperature at various levels in the pavement, however, it has the capability of using 30 temperature thermocouples.

CONCLUSIONS

Summary

The contractor completed the job in approximately nine months, beginning in April 1995 and ending by January 1996. The ALF device was moved in place over lane 002 by Nichols Construction Company in January 1996 to complete the project. Testing for the first experiment began in February 1996.

Construction cost

Table 8 shows the final cost of construction for each individual lane expressed in dollars per square yard. These costs were based on this contract's pricing and do not reflect normal contract pricing.

Table 8
Construction Cost of Each Lane

LANE NO.	BASE COST (0NLY), $/Yd^2	OVERLAY, COST, $/Yd^2	TOTAL COST $/Yd^2
002	$ 25.76	$ 13.75	$ 39.51
003	$ 32.21	$ 13.75	$ 49.96
004	$ 25.76	$ 13.75	$ 39.51
005	$ 25.76	$ 13.75	$ 39.51
006	$ 25.76	$ 13.75	$ 39.51
007	$ 32.21	$ 13.75	$ 49.96
008	$ 25.76	$ 13.75	$ 39.51
009	$ 25.76	$ 13.75	$ 39.51
010	$ 25.76	$ 13.75	$ 39.51

LIST OF ACRONYMS

ALF - Accelerated Loading Facility

DOTD - Louisiana Department of Transportation and Development

GTM - Gyratory Testing Machine

GSI - Gyratory Shear Index

HMAC - Hot Mix Asphaltic Concrete

LTRC - Louisiana Transportation Research Facility

LVDT -

PRF - Pavement Research Facility

REFERENCES

1. *Louisiana Standard Specifications For Roads and Bridges,* 1992 Edition, State of Louisiana Department of Transportation and Development, Baton Rouge, La., 1992.

Appendix A

Construction Specifications

STATE PROJECT NO. 600-21-0008
SPECIAL PROVISIONS

The content of these special provisions are as they appear in the original contract and have not been modified from it's original format.

This project is primarily for the construction of nine (9) experimental base course test sections which, will be evaluated utilizing the Accelerated Loading Facility (ALF). Because these are comparison texts, materials uniformity and thickness requirements are of utmost importance. All individual materials utilized on this project shall be of the same type and from the same source throughout the project duration. Required layer thicknesses, elevations and grades are to be strictly maintained for each test pavement. Equipment and construction procedures shall be utilized to assure uniformity throughout each pavement layers length, width and thickness. The layers of each test section will be instrumented with various sensors by LTRC personnel during construction. The contractor will coordinate activities with the project engineer to allow time for instrumentation activities and during construction to protect the installed sensors from damage.

Upon completion of this contract, the contractor shall return the site to its original condition with the exception of the items constructed under this contract. All material, labor and any incidentals required to complete the construction of this contract shall be in accordance with the plans, the Standard Specifications for Roads and Bridges, 1992 edition and these special provisions.

CENTRAL MIX PLANT: The central mix plant for this contract shall be located off the Pavement Research Facility site and mixing for the various test lanes shall be in accordance with section 301 of the standard specifications.

ITEM S-001, PAVEMENT TEST PARKING LANE BASE: This work consists of constructing the parking lane base for the testing facility in accordance with the plans, specifications and these special provisions. The existing embankment material in the area shown for this item shall be scarified and compacted and any deficient areas filled and compacted using select soil from the stockpile as specified under Item S-012, Stockpiled Select Soil, to achieve proper grade as shown in the plans and in accordance with section 203 of the standard specifications.

A 12 inch stone base course shall be placed in accordance with section 301 of the Standard Specifications as modified by the following. The stone base course material shall be obtained from the stockpile as specified under Item S-011, Stockpiled Crushed Stone, and as specified in section 1003.03(d) and be placed on the prepared and approved existing embankment surface. Thickness and density requirements shall be in accordance with section 301.16(a) and 301.16(b) and as specified herein, except each pavement test strip will be a lot for acceptance purposes. Grade adjustments for underthickness of the placed and compacted material will be permitted by adding and compacting additional stone. Overthickness requirements will not be waived. Thickness control for the final elevation of the placed, compacted and finished stone layer shall not deviate from the established grade and thickness indicated on the plans by more than ± 0.25 inch. The frequency of in-place density tests will be determined by the engineer. The completed base shall be protected and cured by an asphaltic prime coat in accordance with section 505 and section 301.12(b) of the Standard Specifications.

The Pavement Test Parking Lane Base shall be measured by the lump sum and made at the contract unit price under:

Item S-001, Pavement Test Parking Lane Base, Lump Sum.

ITEM S-002, PHASE I CONTROL LANE BASE: This item consists of constructing the subbase and base of the control lane for Phase I in accordance with the plans, specifications and these special provisions. This includes constructing an 8½ inch stone base placed over a 3½ inch select soil subbase including a soil stabilization geotextile fabric at the base/subbase interface. The existing embankment material in the area shown for this item shall be scarified and compacted and any deficient areas filled and compacted using select soil from the stockpile as specified under Item S-012, Stockpiled Select Soil, to achieve proper grade as shown in the plans and in accordance with section 203 of the standard specifications.

The 3½ inch layer of select soil shall be obtained from the stockpiled material specified under Item S-012, Stockpiled Select Soil and placed on the prepared and approved existing embankment. The select soil layer shall be constructed in accordance with section 203 of the standard specifications and to grade as shown on the plans within ± 0.25 inch. A single layer of soil stabilization geotextile fabric shall be furnished and placed on the prepared and approved soil subbase layer. The fabric shall be installed to proper width and length without seams or overlap, except end overlap will be allowed outside the middle 100 feet of the test lane. The minimum overlap shall be 4 feet. The fabric shall be a class "C" geotextile fabric in accordance with section 1019.01 and 1019.03 of the Standard Specifications. The material shall be placed in accordance with Section 203.11 of the Standard Specifications as modified herein.

The 8½ inch thick stone base layer shall be placed in accordance with section 301 of the Standard Specifications as modified by the following: The stone base course shall be as specified in Section 1003.03(d) of the Standard Specifications and shall be from a single approved source for this project and obtained from the stockpile as specified under Item S-011, Stockpiled Crushed Stone. Thickness and density requirements shall be in accordance with section 301.16(a)(3) and 301.16(b) except each pavement test lane will be considered a lot for acceptance purposes. Grade adjustments for underthickness will be permitted by adding and compacting additional material. Overthickness requirements will not be waived. Thickness control for the final elevation of the placed, compacted and finished select soil and stone layer shall not deviate from the established grades and thicknesses indicated on the plans by more than ± 0.25 inch. The frequency of in-place density tests will be determined by the engineer. The completed base shall be protected and cured by an asphaltic prime coat in accordance with section 505 and section 301.12(b) of the Standard Specifications.

Phase I Control Lane Base shall be measured by the lump sum and made at the contract unit price under:

Item S-002, Phase I Control Lane Base, Lump Sum.

ITEM S-003, PHASE I - TEST LANE "A" STONE BASE: This item consists of the subbase and base of Phase I, Test Lane "A," which will be constructed in accordance with the plans, standard specifications and these special provisions. This includes constructing a 5½ inch stone base layer over a 6½ inch select soil subbase layer including a geogrid and soil stabilization geotextile fabric at the base/subbase interface. The existing embankment in the area shown for this item shall be scarified, compacted, and any deficient areas filled and compacted using select soil from the stockpile as specified under Item S-012, Stockpiled Select Soil, to achieve proper grade as shown in the plans and in accordance with section 203 of the standard specifications.

A 6½ inch compacted layer of select soil shall be constructed from stockpiled material specified under Item S-012, Stockpiled Select Soil and placed on the prepared and approved existing embankment surface. The select soil layer shall be constructed in accordance with section 203 of the standard specifications and to grade as shown on the plans within ± 0.25 inch. The geogrid shall be a polymer type with a required minimum strength at 5% strain of 55 pounds per linear feet in both the machine direction and the cross machine direction when tested in accordance with ASTM D 4595-86. The geogrid shall have a minimum aperture size of ½ inch in both the machine and cross machine directions. The geogrid shall be installed on the accepted select soil layer prior to installing the soil stabilization fabric. The geogrid shall be a single layer, installed to proper width and length without seams or overlap except that end overlap will be allowed outside the middle 100 feet of the test lane. The minimum overlap shall be 2 feet.

A single layer of soil stabilization geotextile fabric shall be furnished and placed over the geogrid in accordance with section 201.11. The fabric shall be installed to proper width and length without seams or overlap, except that end overlap will be allowed outside the middle 100 feet of the test lane. The minimum overlap shall be 4 feet. The fabric shall be a class "C","D" or "S" geotextile fabric in accordance with section 1019 of the Standard Specifications.

A 5½ inch thick stone base course shall be placed in accordance with section 301 of the Standard Specifications as modified by the following: The stone base course shall be as specified in section 1003.03(d) from an approved single source for this project and obtained from stockpile as specified under Item S-011, Stockpiled Crushed Stone. Thickness and density requirements shall be in accordance with section 301.16(a) and 301.16(b) except each pavement test strip will be considered a lot for acceptance purposes. Grade adjustments for underthickness will be permitted by adding and compacting additional stone. Overthickness requirements will not be waived. Thickness control for the final elevation of the placed, compacted and finished soil and stone layer shall not deviate from the established grade and thickness indicated on the plans by more than ± 0.25 inch. The frequency of in-place density tests will be determined by the engineer. The completed base shall be protected and cured by an asphaltic prime coat in accordance with section 505 and section 301.12(b) of the Standard Specifications.

Phase I - Test Lane "A" Stone Base shall be measured by the Lump Sum and made at the contract unit price under:

Item S-003, Phase I - Test Lane "A," Stone Base, Lump Sum.

ITEM S-004, PHASE I - TEST LANE "B" BASE: This item consists of constructing the subbase and base for Phase I - Test Lane "B" in accordance with the plans, specifications and these special provisions. This includes constructing a composite 4 inch stone base over a 6 inch stone stabilized base and 2 inch select soil subbase. The existing embankment in the area shown for this item shall be scarified and compacted and any deficient areas filled and compacted using select soil from the stockpile as specified under Item S-012, Stockpiled Select Soil, to achieve proper grade as shown in the plans and in accordance with section 203 of the standard specifications.

A 6¼ inch compacted layer of select soil shall be constructed to grade as shown on the plans on the prepared and approved embankment using material obtained from the stockpiled material Item S-012, Stockpiled Select Soil. A 2¼ inch loose layer of stone shall be placed on top of the compacted select soil and mixed in-place to a depth of 6½ inches and compacted in accordance with section 301 of the standard specifications. Compaction requirements for the stone stabilized layer shall meet minimum density requirements as indicated in subsection 301.16(a) for stone. The stone material shall be obtained from the stockpile specified under Item S-011, Stockpiled Crushed Stone. This equates into a usage of approximately 35 percent stone by weight for the stone stabilized layer. Thickness requirements are as indicated in section 301.16(b)(3) with underthickness grade adjustments permitted by adding and compacting additional mixed soil and stone. Requirements for over thickness will not be waived. Final grade to be within ± 0.25 inch.

The 4 inch stone base course shall be constructed in accordance with Section 301 of the Standard Specifications over the stone stabilized base and as modified by the following: The stone base shall be obtained from the stockpiled material specified under Item S-011, Stockpiled Crushed Stone. Thickness and density requirements shall be in accordance with section 301.16(a)(3) and 301.16(b)(3) except each pavement test strip will be considered a lot for acceptance purposes. Grade adjustments for underthickness will be permitted by adding and compacting additional stone. Overthickness requirements will not be waived. Thickness control for that the final elevation of the placed, compacted and finished soil, stone stabilized layer, and stone base shall not deviate from the established grades and thickness indicated on the plans by more than ± 0.25 inch. The frequency of in-place density tests will be determined by the engineer. The completed base course shall be protected and cured by an asphaltic prime coat according to section 505 and section 301.12(b) of the Standard Specifications.

Phase I - Test Lane "B" Base shall be measured by the lump sum and made under:

Item S-004, Phase I - Test Lane "B," Lump Sum.

ITEM S-005, PHASE II - CONTROL LANE BASE: This item consists of constructing the subbase and base of the Control Lane for Phase II in accordance with the plans, specifications, and these special provisions. This includes constructing an 8½ inch central plant mix soil cement base over a 3½ inch select soil subbase. The existing embankment in the area shown for this item shall be scarified and compacted and any deficient areas filled and compacted using select soil from the stockpile as specified under Item S-012, Stockpiled Select Soil, to achieve proper grade as shown in the plans and in accordance with section 203 of the standard specifications.

The 3½ inch layer of select soil shall be obtained from the stockpiled material specified under Item S-012, Stockpiled Select Soil, and constructed on the prepared and approved existing embankment layer. The select soil shall be placed and compacted in accordance with section 203 achieving the grade as shown on the plans to within ±0.25 inch.

The 8½ inch soil cement stabilized base layer shall be placed on prepared and approved subbase. The stabilized material shall consist of select soil obtained from the stockpiled material specified under Item S-012, Stockpiled Select Soil. In addition to the material required for construction, adequate supplies of cement in accordance with section 301 of the Standard Specifications must be provided to allow for calibration and testing. The material shall be mixed in a central mix plant in accordance with section 301 of the Standard Specifications. The amount of cement for soil cement shall be 10 percent by volume and all cement used on the project shall be from a single approved source. Mixed material used for calibration and testing shall be disposed of by the contractor at no direct pay.

Loading, transporting, and placing on the prepared and approved select soil subbase shall be in accordance with section 301.08. Grade control shall be by automatic finishing machine and maintained from an erected stringline in accordance with section 301.09. Compacting and finishing shall be in accordance with sections 301.10(a) and 301.11. No construction joints will be allowed. Thickness requirements for the soil cement base shall not vary from plan thickness and grade in excess of ±0.25 inch. Base course thickness in excess of plan thickness shall be corrected by blading or shaving prior to final compaction. Base course underthickness in excess of 0.25 inch will not be allowed and the deficient base shall be removed and replaced. The addition of base material or asphaltic concrete to achieve proper thickness and grade will not be allowed. Partial patching will not be allowed. Density requirements will be in accordance with section 301.16, except that no pay adjustments will be made. When density test values for the section are below 95.0 percent, the base shall be removed and reconstructed at no direct pay. The completed base shall be protected and cured by an asphaltic curing membrane in accordance with section 506 and section 301.12(a) of the Standard Specifications.

Phase II - Control Lane Base shall be measured by the lump sum and made at the contract unit price under:

Item S-005, Phase II- Control Lane, Lump Sum.

ITEM S-006, PHASE II - TEST LANE "A" BASE: This item consists of constructing the subbase and base sections for Phase II-Test Lane "A" Base shall be constructed in accordance with the plans, specifications and the following special provisions. This includes construction of an 8½ inch central plant mix soil cement base over a 3½ inch select soil subbase. The existing embankment in the area shown for this item shall be scarified, compacted and any deficient areas filled and compacted using select soil from the stockpile as specified under Item S-012, Stockpiled Select Soil, to achieve proper grade as shown in the plans and in accordance with section 203 of the standard specifications.

The 3½ inch layer of select soil shall be obtained from stockpiled material as specified under Item S-012, Stockpiled Select Soil, and constructed on the prepared and approved existing embankment surface. The select soil shall be placed and compacted in accordance with section 203 achieving the grade as shown on the plans to within ±0.25 inch.

The 8½ inch modified soil cement stabilized base layer shall be constructed on the prepared and approved subbase. The construction and testing of this central plant mix layer shall meet all requirements necessary in accordance with section 301 of the standard specifications. The stabilized material shall consist of select soil obtained from the stockpile as specified under Item S-012, Stockpiled Select Soil. In addition to the material required for construction, adequate supplies of cement must be provided to allow for calibration and testing. Mixed material used for calibration and testing shall be disposed of by the contractor at no direct pay. Mixing of the soil cement shall be in accordance with 301.06 except the moisture content shall be 2-4 percent below optimum. The amount of cement for the modified soil cement shall be 4.0 percent by volume and all cement used on the project shall be from an approved single source.

Loading, transporting and placing on the prepared and approved select soil subbase shall be in accordance with section 301.08. Grade control shall be by automatic finishing machine and maintained from an erected stringline and shall be in accordance with section 301.09. Compacting and finishing shall be in accordance with sections 301.10(a) and 301.11. No construction joints will be allowed. Thickness requirements for the soil cement base shall not vary from plan thickness and grade in excess of ±0.25 inch. Base course thickness in excess of plan thickness shall be corrected by blading or shaving prior to final compaction. Base course underthickness in excess of 0.25 inch will not be allowed, and the deficient base shall be removed and replaced. The addition of base material or asphaltic concrete to achieve proper grade will not be allowed. Partial patching will not be allowed. Density requirements will be in accordance with section 301.16, except a minimum of 97.0 percent density value will be required and no pay adjustment will be made. When density test values for the section are below 97 percent, the base shall be removed and reconstructed at no direct pay. The completed base shall be protected and cured by an asphaltic curing membrane in accordance with section 506 and section 301.12(a) of the Standard Specifications.

Phase II - Test Lane "A" base and subbase shall be measured by the lump sum and made under:

Item S-006, Phase II - Test Lane "A," Lump Sum.

ITEM S-007, PHASE II - TEST LANE "B" BASE: This item consists of the construction the subbase and base for Phase II - Test Lane "B" Base in accordance with the plans, specifications, and the following special provisions. This includes constructing an 8½ inch central plant-mix soil cement base with fibers over a 3½ inch select soil subbase. The existing embankment in the area shown for this item shall be scarified, compacted and any deficient areas filled and compacted using select soil from the stockpile as specified under Item S-012, Stockpiled Select Soil, to achieve proper grade as shown in the plans and in accordance with section 203 of the standard specifications.

The 3½ inch layer of select soil shall be obtained from the stockpiled material as specified under Item S-012, Stockpiled Select Soil and constructed on the prepared and approved existing embankment surface. The select soil shall be placed and compacted in accordance with section 203 achieving the grade as shown on the plans to within ±0.25 inch.

The 8½ inch modified soil cement and fiber stabilized base layer shall be constructed on the prepared and approved subbase. The construction and testing of this central plant mix with fibers layer shall meet all requirements necessary in accordance with section 301 of the standard specifications. The stabilized material shall consist of select soil obtained from the stockpiled material as specified under Item S-012, Stockpiled Select Soil. In addition to the material required for construction, adequate supplies of cement must be provided to allow for calibration and testing. Mixed material used for calibration and testing shall be disposed of by the contractor at no direct pay. Mixing of the soil cement shall be in accordance with 301.06 except the moisture content shall be 2-4 percent below optimum. The percentage of cement for the modified soil cement shall be 4 percent by volume, and all cement used on the project must be from a single approved source. This soil cement mixture will include the addition of 0.02% by weight fibrillated polypropylene fibers. The fibers shall be discrete, fibrillated polypropylene fibers donated and manufactured by Synthetic Industries, 4019 Industry Drive, Chattanooga, TN 37416. The fibers shall be proportioned by weight and should be introduced into the mixing process with the other components.

Loading, transporting and placing of the soil cement base on the prepared and approved select soil subbase shall be in accordance with section 301.08. Grade control shall be by automatic finishing machine and maintained from an erected stringline according to sections 301.10(a) and 301.11. No construction joints will be allowed. Thickness requirements for the soil cement base shall not vary from plan thickness and grade in excess of ±0.25 inch. Base course thickness in excess of plan thickness shall be corrected by blading or shaving prior to final compaction. Base course underthickness in excess of 0.25 inch will not be allowed and the deficient base shall be removed and replaced. The addition of base material or asphaltic concrete to achieve proper thickness and grade will not be allowed. Partial patching will not be allowed. Density requirements for the base will be in accordance with section 301.16, except a minimum of 97 percent density value will be required and no pay adjustments will be made. When density test values for the section are below 97.0 percent, the base shall be removed and reconstructed at no direct pay. The completed base shall be protected and cured by an asphaltic curing membrane in accordance with section 506 and section 301.12(a) of the Standard Specifications.

Phase II - Test Lane "B" base and subbase shall be measured by the lump sum and made under:

Item S-007, Phase II - Test Lane "B," Lump Sum.

ITEM S-008 PHASE III - CONTROL LANE: This item consists of constructing the subbase and base layers of the Phase III - Control Lane Base in accordance with the plans, specifications and these special provisions. This includes constructing an 8½ inch in place mixed soil cement base over a 3½ inch select soil subbase in accordance with the Standard Specifications and as modified herein. The existing embankment in the area shown for this item shall be scarified, compacted and any deficient areas filled and compacted using select soil from the stockpile as specified under Item S-012, Stockpiled Select Soil, to achieve proper grade as shown in the plans and in accordance with section 203 of the standard specifications.

A 12 inch layer of select soil obtained from the stockpiled material as specified under Item S-012, Stockpiled Select Soil, shall be placed and compacted on the prepared and approved existing embankment surface in accordance with section 203 of the standard specifications and to grade as shown in the plans. The equipment for in place cement stabilization shall be in accordance with Section 303.03 of the Standard Specifications except the in-place mixer shall have a minimum cutting width of 8 ft. and a minimum mixing depth of 9 inches.

The percentage of cement for the soil cement shall be 10 percent by volume, and all cement used on the project shall be from a single approved source. The required amount of cement shall be spread on the compacted and approved test bed through an approved calibrated spreader box according to section 303.04 and mixing shall be in accordance with section 303.05 except that the sequence of mixing shall be as follows: The initial pass shall start at either edge of the test lane with the second pass to start at the opposite edge. The final pass shall be centered on this test lane. No construction joints will be allowed. Compacting and finishing shall conform to section 303.06 except that the final finish grade shall be such that the plan depth of 8½ inches will be achieved.

Grade control shall be by automatic finishing machine and maintained from an erected stringline according to sections 301.10(a) and 301.11. No construction joints will be allowed. The test lane bed elevation shall be checked upon final compaction and finishing and all areas in excess of 0.25 inch above plan grade shall be immediately corrected by tight blading or shaving. If base course underthickness in excess of 0.25 inch is found, the whole base course shall be removed and replaced utilizing the above specified procedures at no direct pay. Density tests will be conducted according to Section 303.11(a) except that any density test below 95 percent will require the entire base to be removed and replaced at no direct pay.

The completed base shall be protected and cured by an asphaltic curing membrane in accordance with section 506 and section 303.08 of the Standard Specifications. Phase III - Control Lane base and subbase shall be measured by the lump sum and made under:

Item S-008, Phase III - Control Lane, Lump Sum.

ITEM S-009, PHASE III - TEST LANE "B" BASE: This Item consists of constructing the base and subbase layers for Phase III - Test Lane "B" base in accordance with plans, specifications and special provisions. This includes constructing a 4 inch stone base course on a 6 inch Class II in place mixed soil cement base over 2 inch select soil subbase. The existing embankment in the area shown for this item shall be scarified, compacted and any deficient areas filled and compacted using select soil from the stockpile as specified under Item S-012, Stockpiled Select Soil, to achieve proper grade as shown in the plans and in accordance with section 203 of the standard specifications.

An 8 inch layer of select soil obtained from the stockpiled material as specified under Item S-012, Stockpiled Select Soil, shall be placed on the prepared and approved existing embankment surface and compacted to grade. The equipment for in-place cement stabilization shall be as shown in section 303.03 of the Standard Specifications except the in-place mixer shall have a minimum cutting width of 8 feet. The percentage of cement for the soil cement layer shall be 10 percent by volume, and all cement used on the project shall be from an approved single source. The required amount of cement shall be spread on the compacted and approved select soil layer through an approved calibrated spreader box according to section 303.04 and mixing shall be in accordance with section 303.05 except the sequence of mixing shall be as follows: The initial pass shall start at either edge of the test lane with the second pass to start at the opposite edge. The final pass shall be centered on the test lane. No construction joints will be allowed. Compaction and finishing shall conform to section 303.06 except that the final finished grade shall be such that plan depth of 6 inches will be achieved.

Grade control shall be by automatic finishing machine and maintained from an erected stringline according to sections 301.10(a) and 301.11. No construction joints will be allowed. The test bed elevation shall be checked upon final compaction and finishing, and all areas in excess of 0.25 inch above the plan grade shall be immediately corrected by tight blading or shaving. If underthickness in excess of 0.25 inch is found, the entire soil cement base shall be removed and replaced utilizing the above specified procedures. Density tests will be conducted according to section 303.11(a), except that any density test below 95 percent will require the entire soil-cement base to be removed and replaced at no direct pay. The completed soil cement base shall be protected and cured by an asphaltic curing membrane in accordance with section 506 and section 303.08 of the Standard Specifications.

A 4 inch stone base course shall be placed on the completed soil cement layer in accordance with section 301 of the Standard Specifications modified by the following: The stone base course material shall be obtained from the stockpile specified under Item S-011, Stockpiled Crushed Stone. Thickness and density requirements are as indicated in section 301.16(a)(3) and section 301.16(b)(3), except each pavement test strip will be considered a lot for acceptance purposes. Grade adjustments for underthickness will be permitted by adding and compacting additional stone. Overthickness requirements will not be waived. Thickness control for the final elevation of the placed, compacted and finished base shall not deviate from the established grades and thicknesses indicated on the plans by more than ± 0.25 inch. The frequency of in place density tests will be determined by the engineer. The completed base course shall be protected and cured by an asphaltic prime coat according to section 505 and section 301.12(b) or the Standard Specifications.

Phase III - Test Lane "B" base shall be measured by the lump sum and made at the contract unit price under:

Item S-009, Phase III - Test Lane "B" Base, Lump Sum.

ITEM S-010, PHASE III - TEST LANE "A" BASE: This item consists of constructing the base layer of the Phase III - Test lane "A" Base in accordance with plans, specifications and these special provisions. This includes constructing a 12 inch modified soil cement stabilized base layer. The existing embankment in the area shown for this item shall be scarified, compacted, and any deficient areas filled and compacted using select soil from the stockpile as specified under Item S-012, Stockpile Select Soil, to achieve proper grade as shown in the plans and in accordance with section 203 of the standard specifications.

The 12 inch modified soil cement stabilized base layer shall be placed on the prepared and approved existing embankment surface. The soil cement will be produced in a central mix plant with select soil obtained from the stockpile specified under Item S-012, Stockpiled Select Soil. In addition to the material required for construction, adequate supplies of cement must be provided to allow for calibration and testing. Mixed material used for calibration and testing shall be disposed of by the contractor at no direct pay. The material shall be mixed according to section 301 of the Standard Specifications. Mixing of the soil cement shall be in accordance with 301.06 except the moisture content shall be 2-4 percent below optimum. The percentage of cement for the modified soil cement shall be 4 percent by volume, and all cement used on the project shall be from a single, approved source.

Loading, transporting, and placing of the soil cement base on the prepared and approved subgrade shall be in accordance with section 301.08 except the soil cement mixture shall be placed in two lifts of approximately equal thickness. Grade control shall be by automatic finishing machine and maintained from an erected stringline according to sections 301.10(a) and 301.11. No construction joints will be allowed. Compaction shall be in accordance with section 301.10 except the sheepsfoot roller spikes must penetrate into the lower lift when compacting the top layer. The lower lift shall be compacted and shaped to approximate density and grade with the upper lift to be placed immediately upon completion of layer one and before any surface drying occurs. Compaction on the upper lift shall start when all materials are in place and continue until surface closure is obtained. The upper lift should be finished approximately 0.25 inch above the finished grade elevation of the base section to allow tight blading or shaving. If final thickness deficiencies in excess of 0.25 inch are measured, the base course shall be removed and replaced utilizing the above specified procedures. Density requirements will be in accordance with section 301.16, except a minimum of 97 percent density value will be required and no pay adjustment will be made. When density test values for the section are below 97.0 percent, the base shall be removed and reconstructed at no direct pay.

The completed base course shall be protected and cured by an asphaltic curing membrane in accordance with section 506 and section 303.08 of the Standard Specifications.

Phase III - Test Lane "A" shall be measured by the lump sum and made at the contract unit price under:

Item S-010, Phase III - Test Lane "A" Base, Lump Sum.

ITEM S-015, TYPE 8 WEARING COURSE ASPHALTIC CONCRETE: This work consists of constructing two lifts of a Type 8 Wearing Course Asphaltic Concrete, as shown on the plans for the experimental test bed according to sections 501 and 503 of the 1992 Standard Specifications for Roads and Bridges or as modified herein.

The intention of this special item is to produce a uniform mix such that true differences in the underlying base courses are realized for the experimental test bed. Hot mix asphalt concrete (HMAC) for each lift shall be produced continuously from a single asphalt plant until the full quantity for the lift has been produced. The material for each lift may be stored in a separate silo until needed at the test bed. The first 100 tons of each lift will be used to assure uniformity of production and shall be placed on the Pavement Research Facility site near the test bed as directed by the engineer. To allow for sampling, the two lifts shall be placed on separate days. The HMAC overlay shall be constructed on the test bed in 13 foot test lane widths as shown in the plans. There will be no truck exchanges allowed in the middle 75 feet for each of the test lanes. Erected stringline method of construction shall be required. Elevations shall be verified using standard surveying practices and will be provided by the contractor as covered in Item S-016, Construction Layout.

A nuclear density device will be used to optimize the rolling pattern for the mix in the parking lane of the ALF Test Bed. The nuclear density device shall also be used in the remainder of the lanes throughout the project as directed by the engineer to verify that a consistent rolling pattern is maintained. It should be noted that the compaction effort required may vary depending on the type of base being covered.

Thicknesses of mixtures will be determined in accordance with DOTD TR 602. Thickness control for each placed, compacted, and finished lift shall not deviate from the established grades and thicknesses indicated on the plans by more than ±0.25 inch. The objective is uniformity of thickness throughout the test bed.

Measurement and payment shall be as shown in sections 501.13 and 501.14 of the Standard Specifications with the following modifications. All mix produced and placed shall conform to requirements for 100 percent payment; there will be no price adjustment allowed. Mix not meeting 100 percent payment will be removed and replaced at no direct pay. For measurement purposes, each lift will be considered a lot.

The completed Type 8 Wearing Course Asphaltic Concrete shall be measured by the ton and made under:

Item S-015, Type 8 Wearing Course Asphaltic Concrete, Ton.

ITEM S-017, RELOCATING ALF MACHINE: This work consists of moving the ALF machine from the temporary parking lane to the completed Phase III, Test Lane "A" constructed under Item S-010. The contractor must have adequate equipment to lift and move the ALF machine which weighs approximately 120,000 pounds without damage to the machine or the surface of the test areas. The contractors shall submit his method for moving the ALF machine to the engineer for approval before any transfer is commenced.

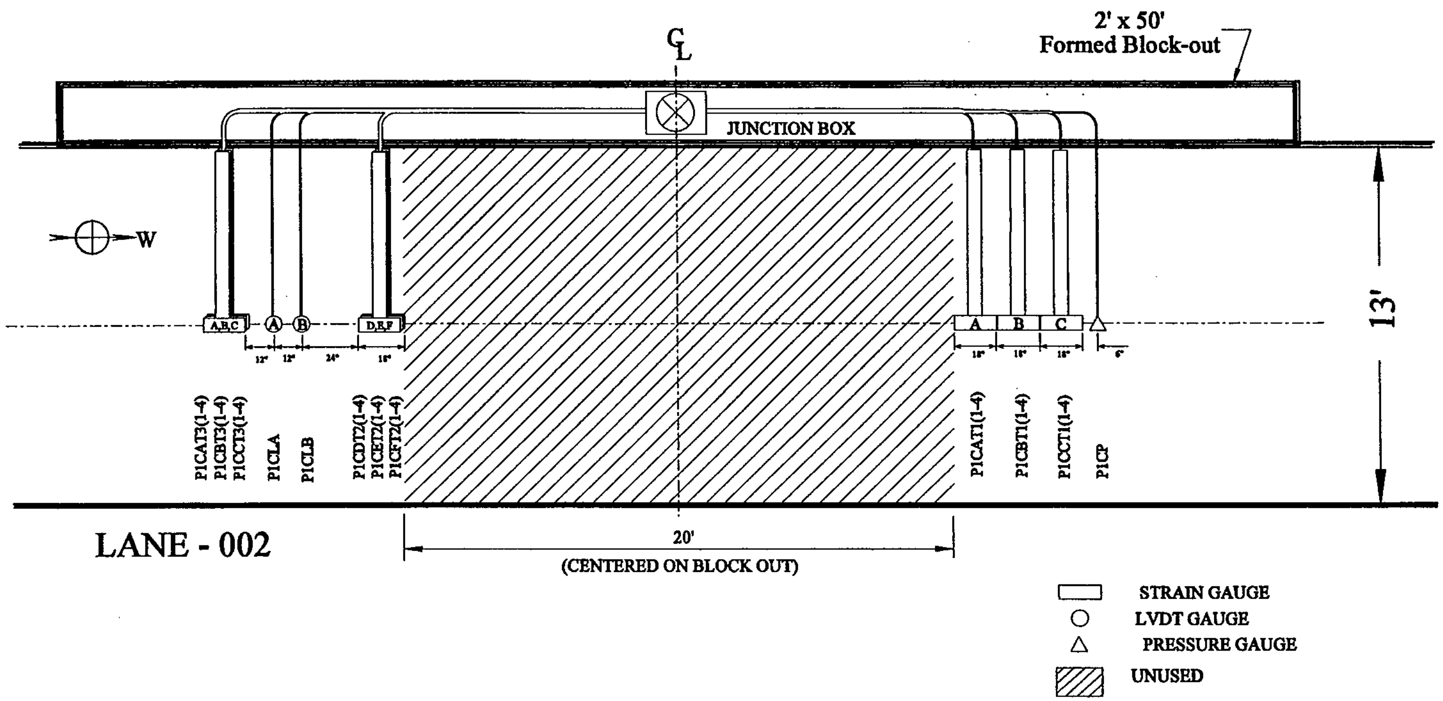
Relocating the ALF machine shall be measured by lump sum and paid for at the contract unit price under:

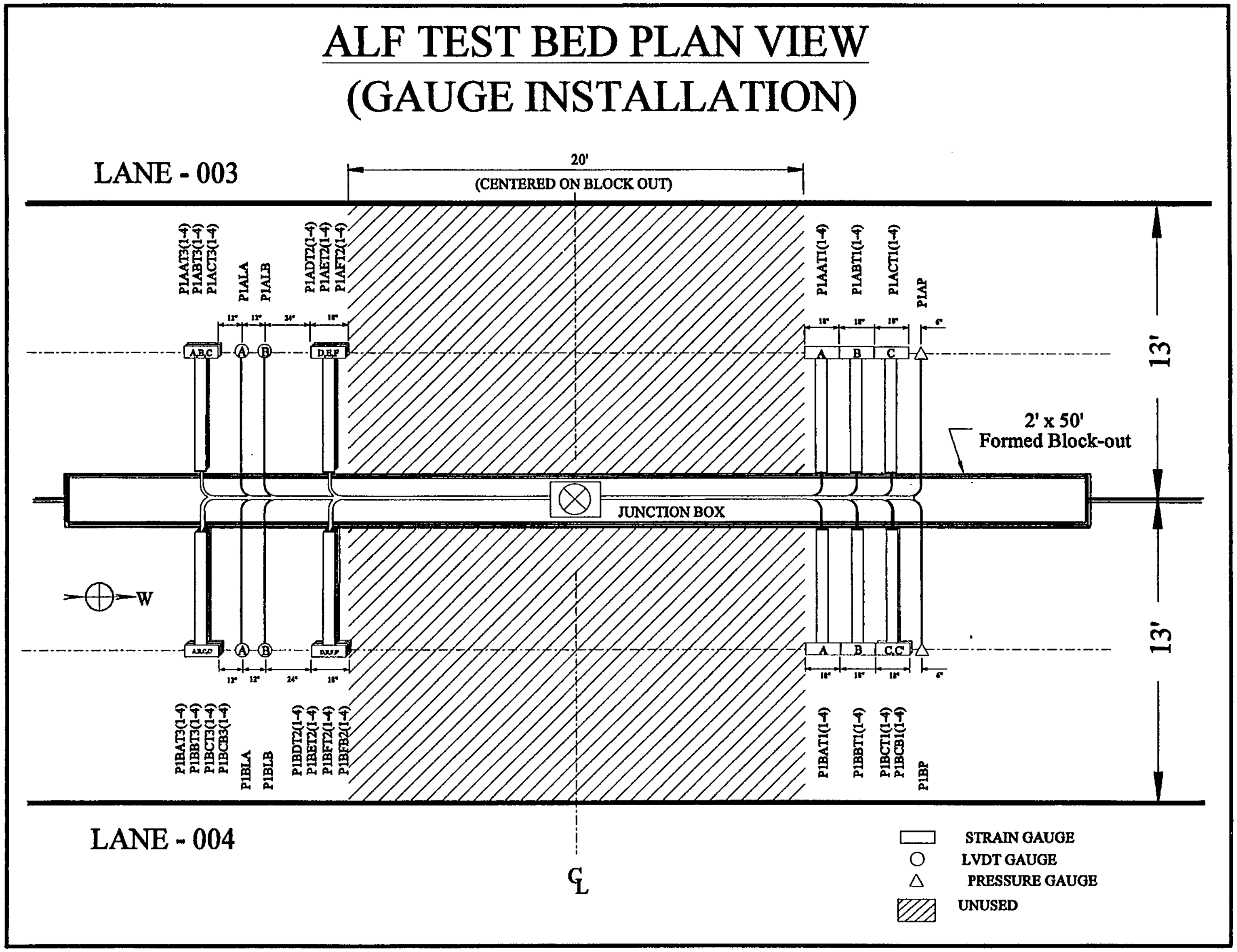
Item S-017, Relocating ALF Machine, Lump Sum.

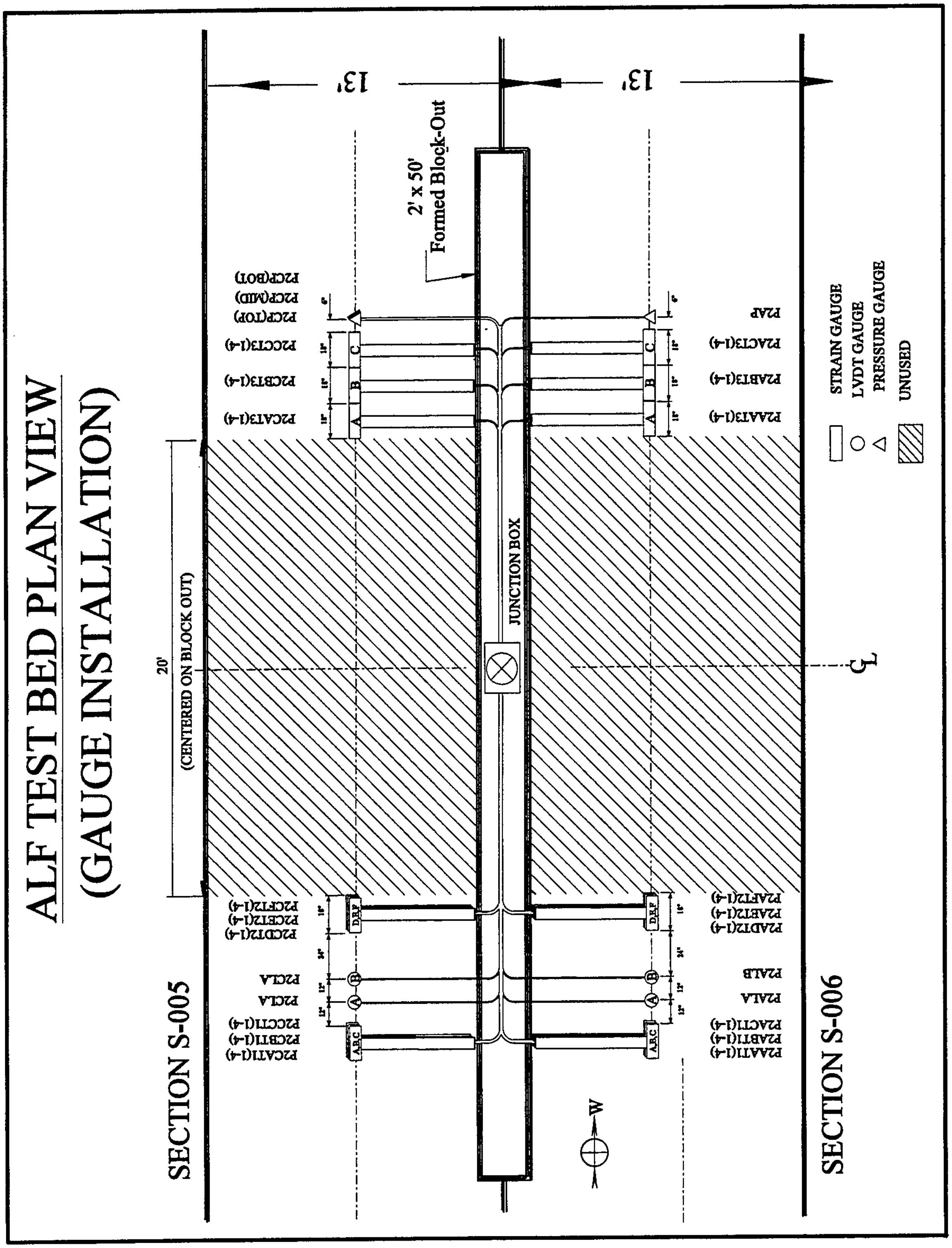
Appendix B

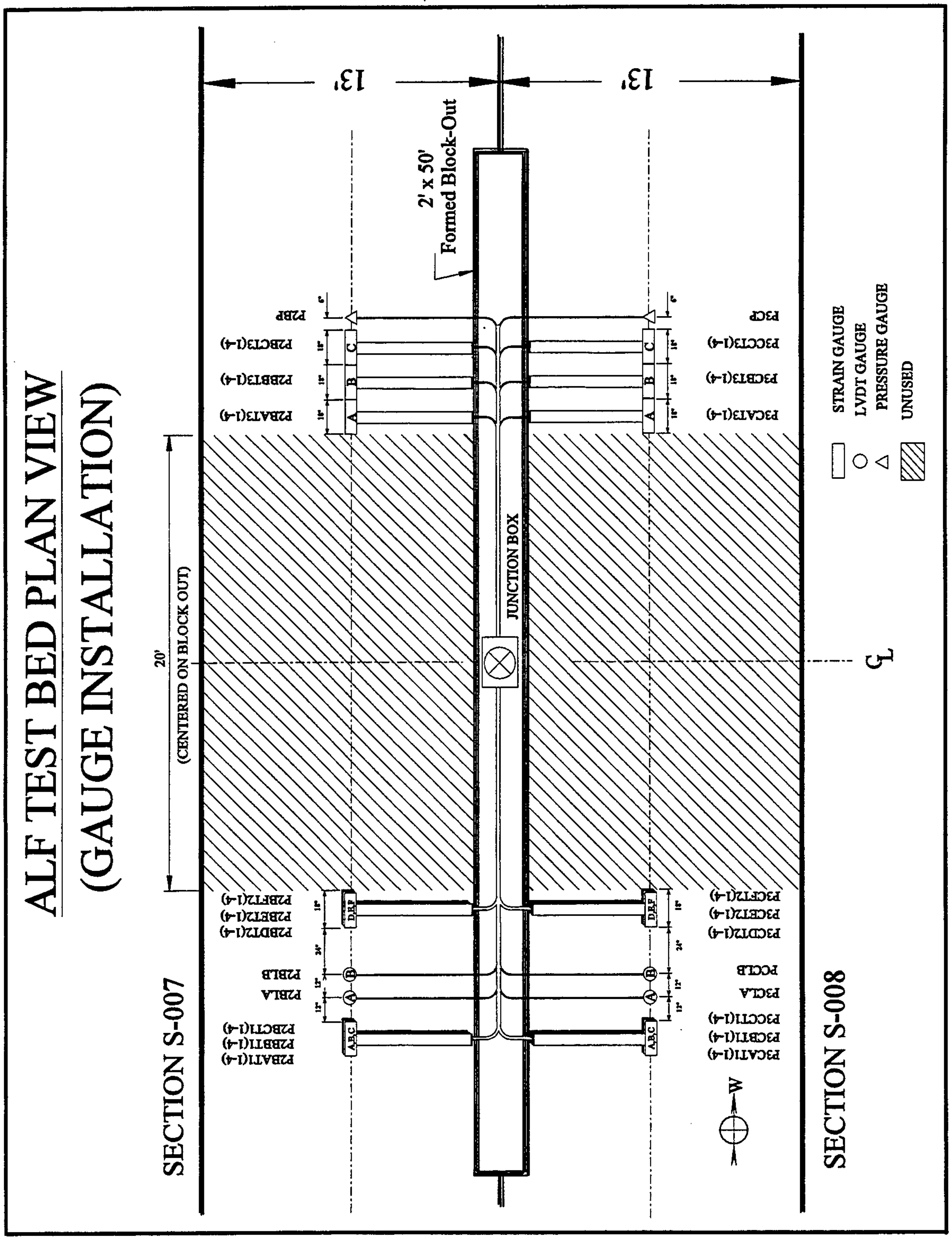
Instrumentation Layout

ALF TEST BED PLAN VIEW
(GAUGE INSTALLATION)

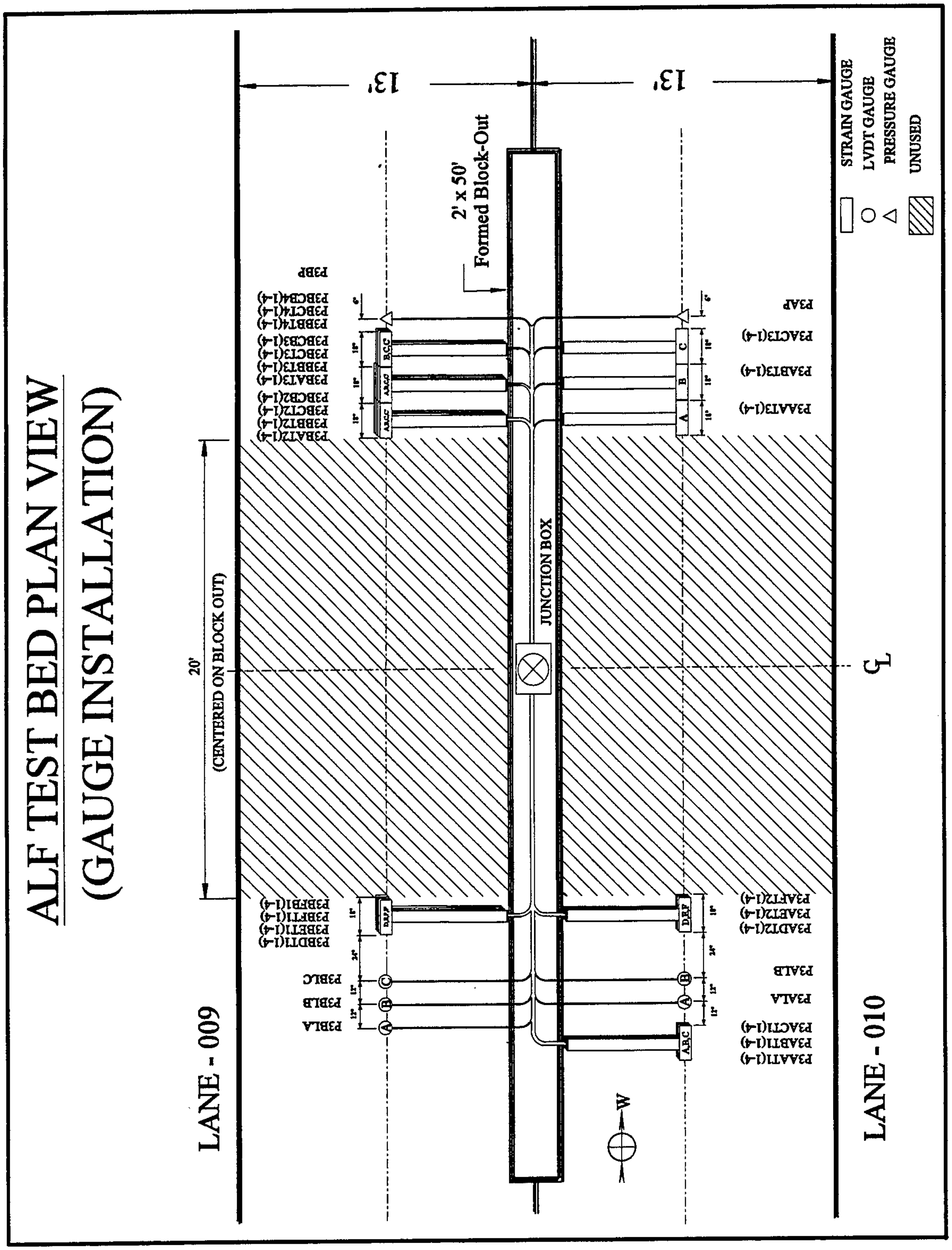



ALF TEST BED PLAN VIEW
(GAUGE INSTALLATION)
LANE - 003
LANE - 004
20'
(CENTERED ON BLOCK OUT)
13'
13'
2' x 50'
Formed Block-out
JUNCTION BOX
W
P1AAT3(1-4)
P1ABT3(1-4)
P1ACT3(1-4)
P1ALA
P1ALB
P1ADT2(1-4)
P1AET2(1-4)
P1AFT2(1-4)
P1AAT1(1-4)
P1ABT1(1-4)
P1ACT1(1-4)
P1AP
P1BAT3(1-4)
P1BBT3(1-4)
P1BCT3(1-4)
P1BCB3(1-4)
P1BLA
P1BLB
P1BDT2(1-4)
P1BET2(1-4)
P1BFT2(1-4)
P1BFB2(1-4)
P1BAT1(1-4)
P1BBT1(1-4)
P1BCT1(1-4)
P1BCB1(1-4)
P1BP
STRAIN GAUGE
LVDT GAUGE
PRESSURE GAUGE
UNUSED

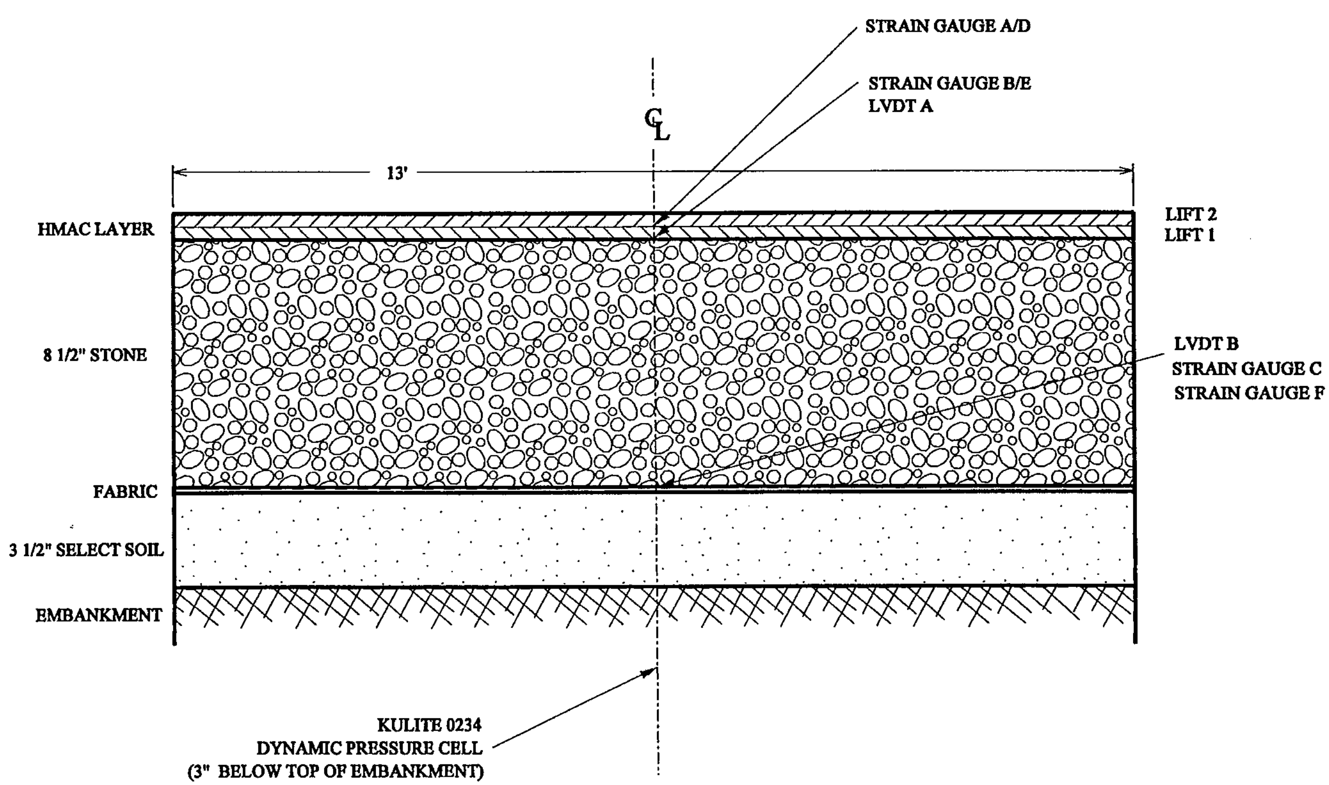

ALF TEST BED PLAN VIEW
(GAUGE INSTALLATION)
SECTION S-005
SECTION S-006
20'
(CENTERED ON BLOCK OUT)
13'
13'
2' x 50'
Formed Block-Out
JUNCTION BOX
STRAIN GAUGE
LVDT GAUGE
PRESSURE GAUGE
UNUSED



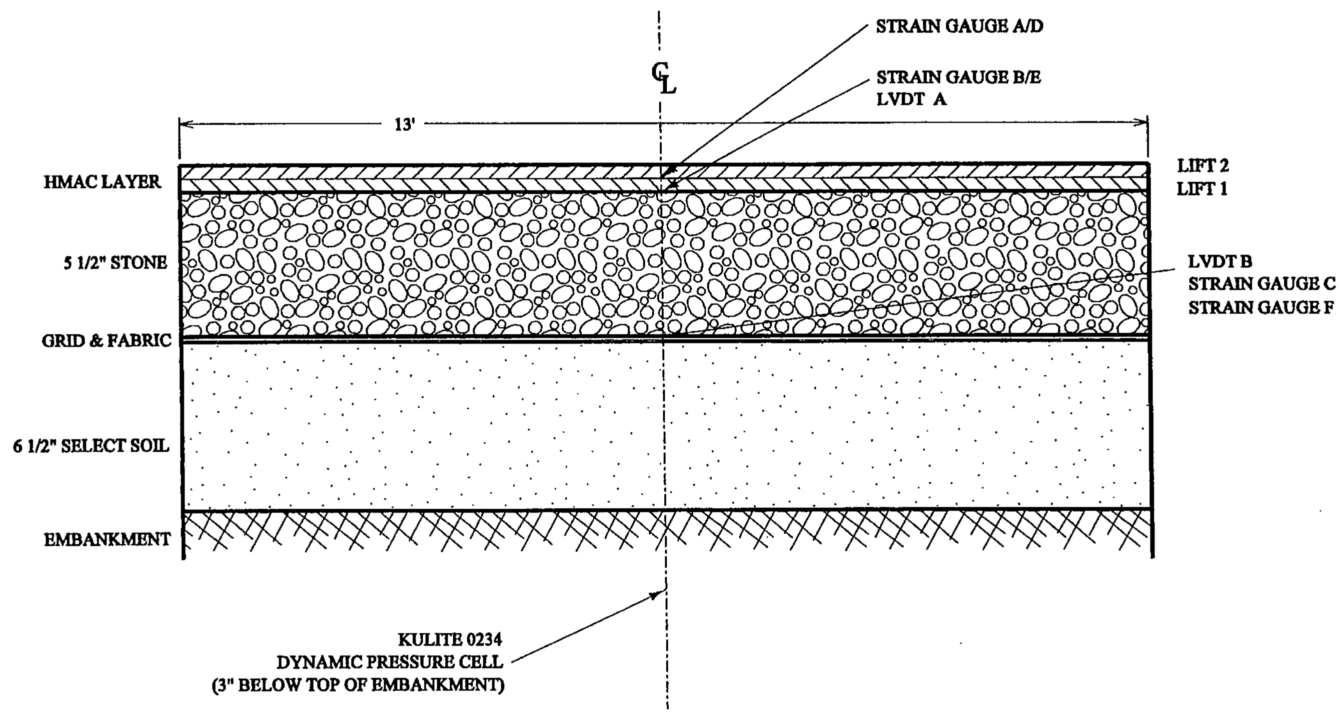
ALF TEST BED PLAN VIEW
(GAUGE INSTALLATION)
SECTION S-007
SECTION S-008
13'
13'
2' x 50'
Formed Block-Out
JUNCTION BOX
20'
(CENTERED ON BLOCK OUT)
STRAIN GAUGE
LVDT GAUGE
PRESSURE GAUGE
UNUSED


ALF TEST BED PLAN VIEW
(GAUGE INSTALLATION)
LANE - 009
LANE - 010
13'
13'
2' x 50'
Formed Block-Out
JUNCTION BOX
20'
(CENTERED ON BLOCK OUT)
STRAIN GAUGE
LVDT GAUGE
PRESSURE GAUGE
UNUSED
W

TYPICAL SECTION
LANE - 002

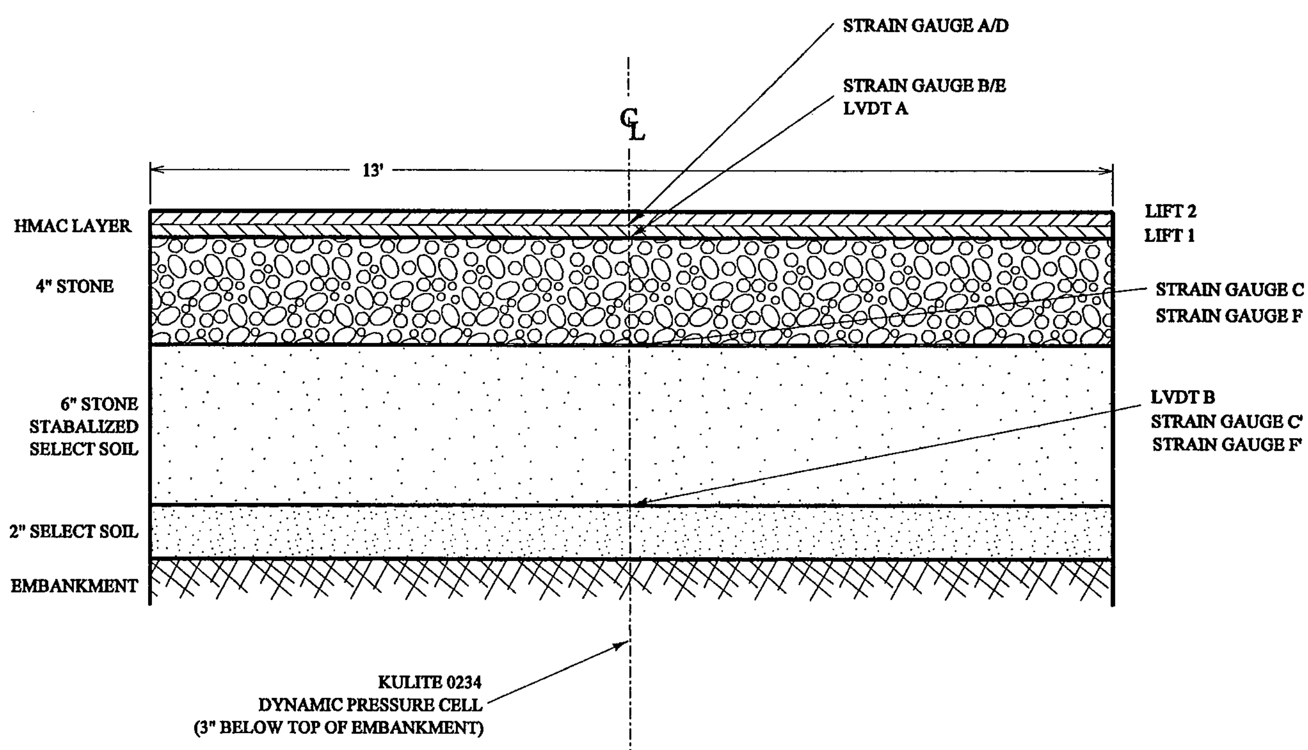


TYPICAL SECTION
LANE - 003



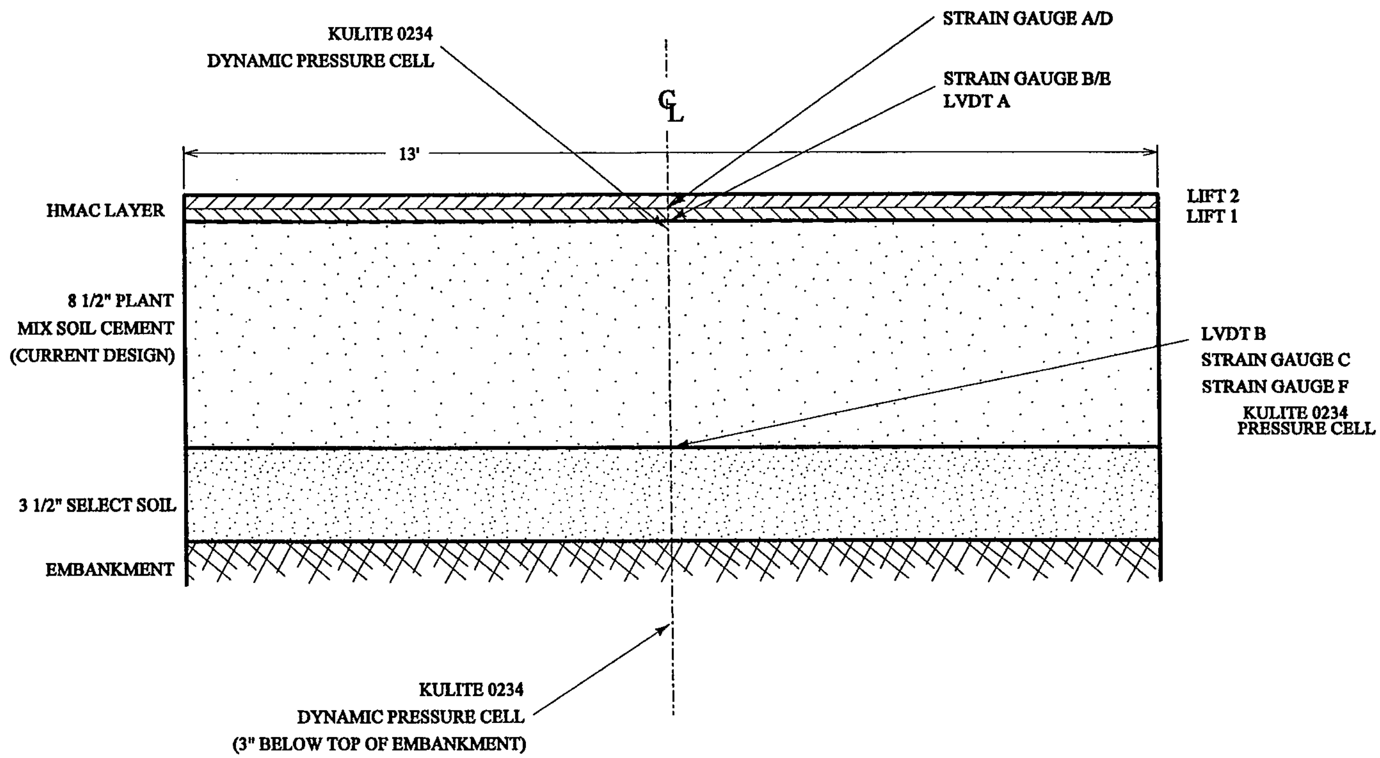
TYPICAL SECTION

LANE - 004

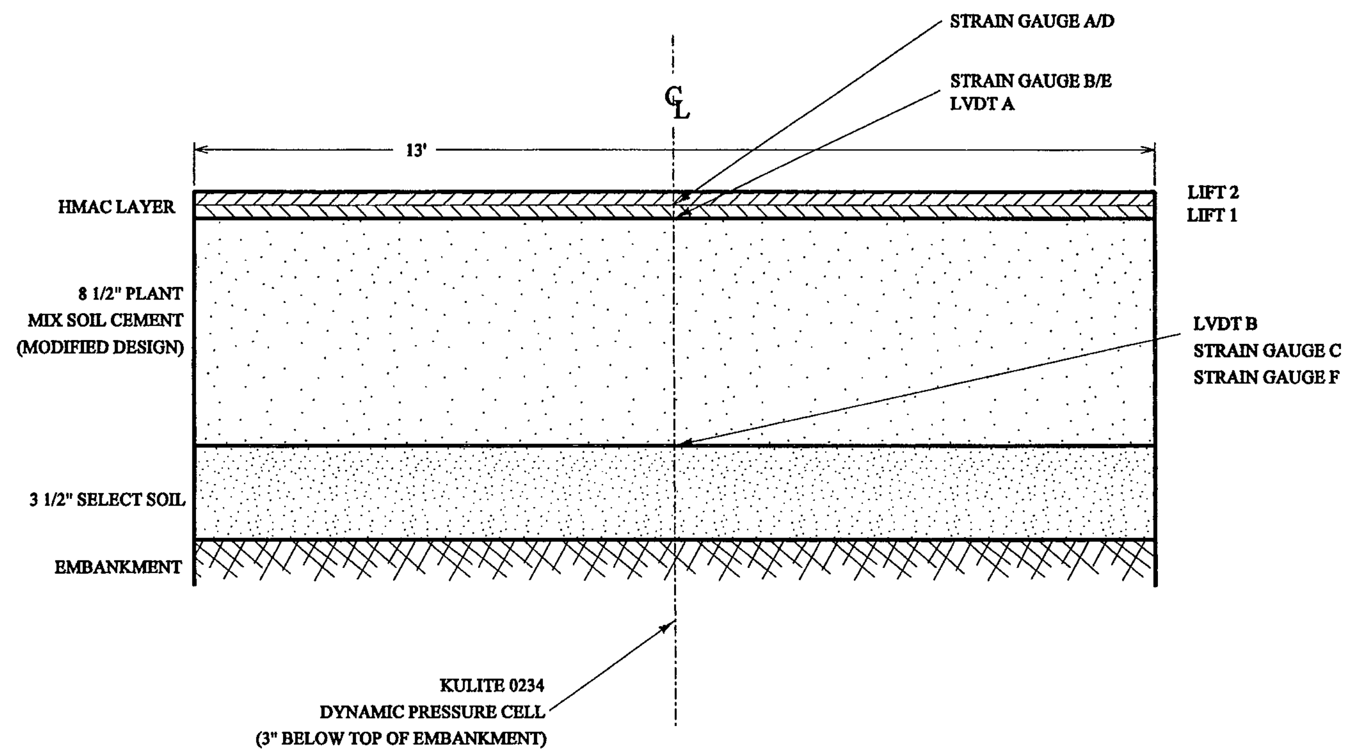


TYPICAL SECTION

LANE - 005

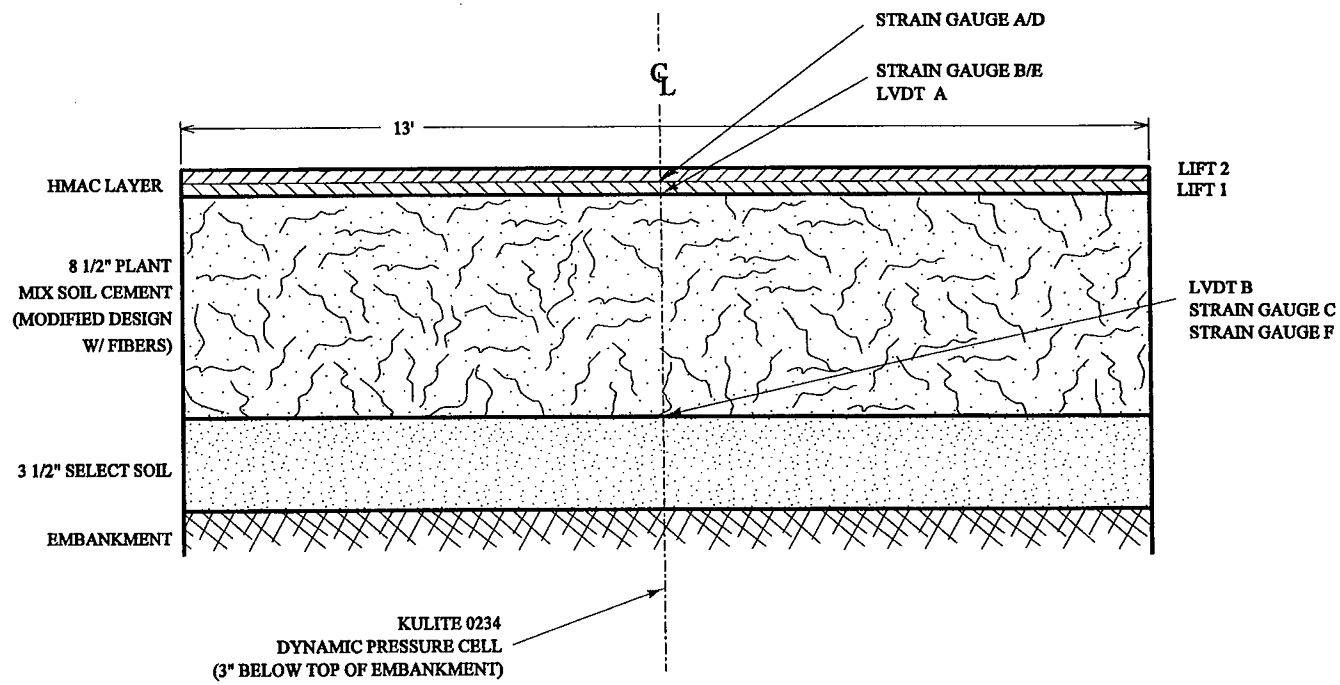


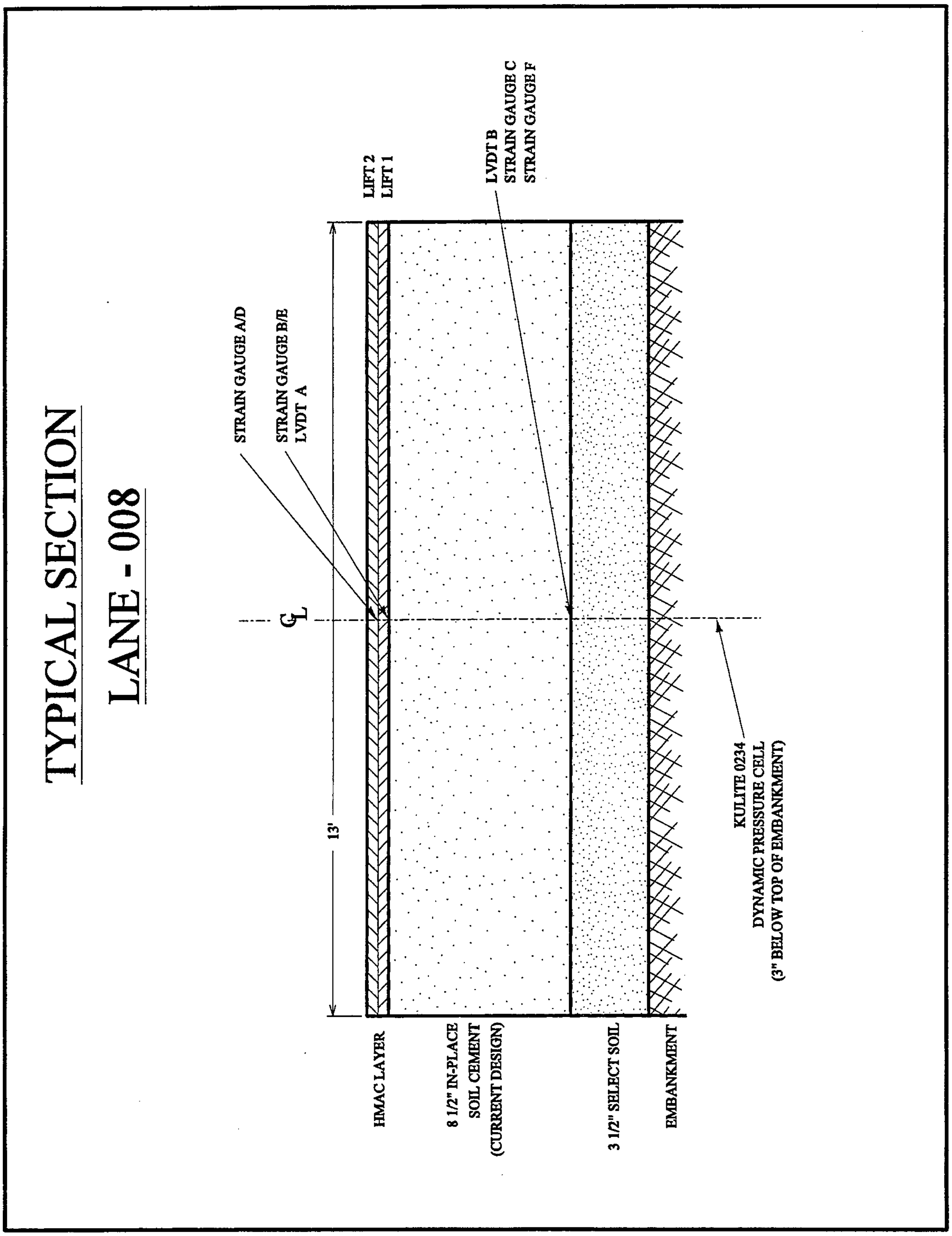
TYPICAL SECTION
LANE - 006



TYPICAL SECTION

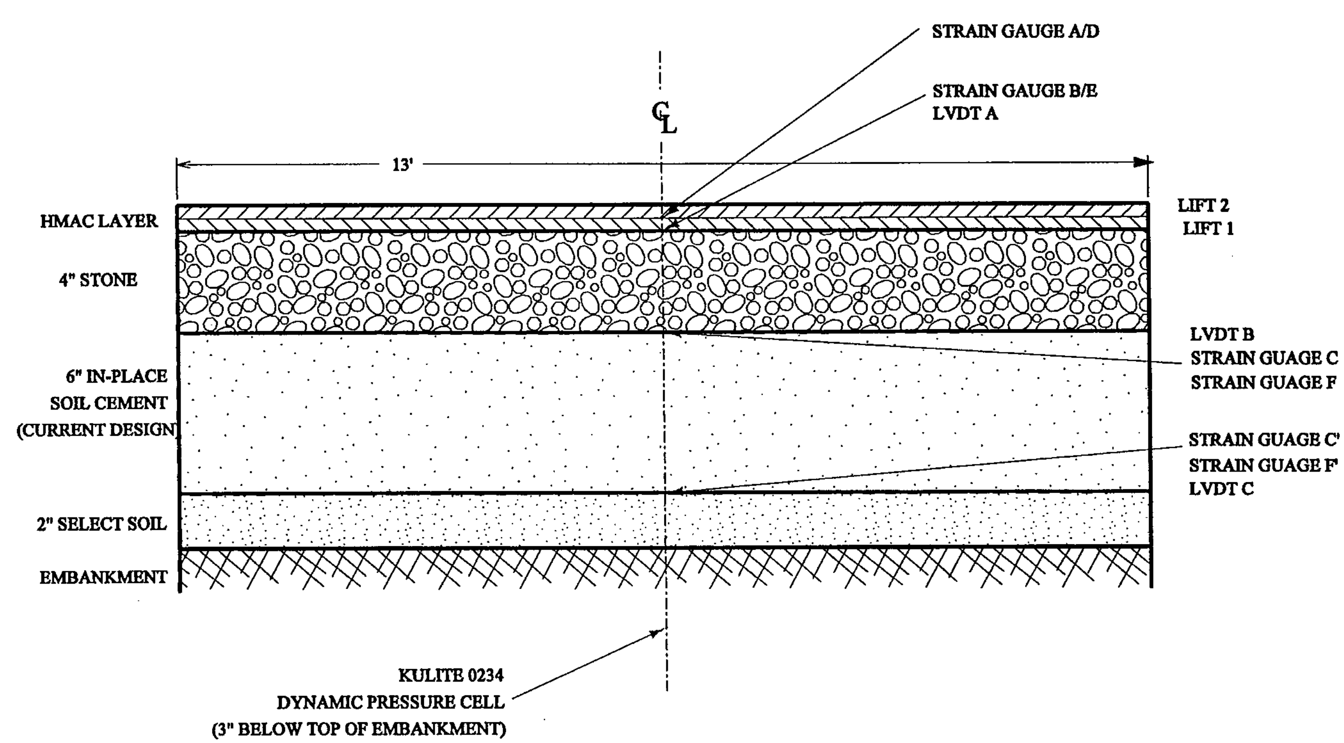
LANE - 007



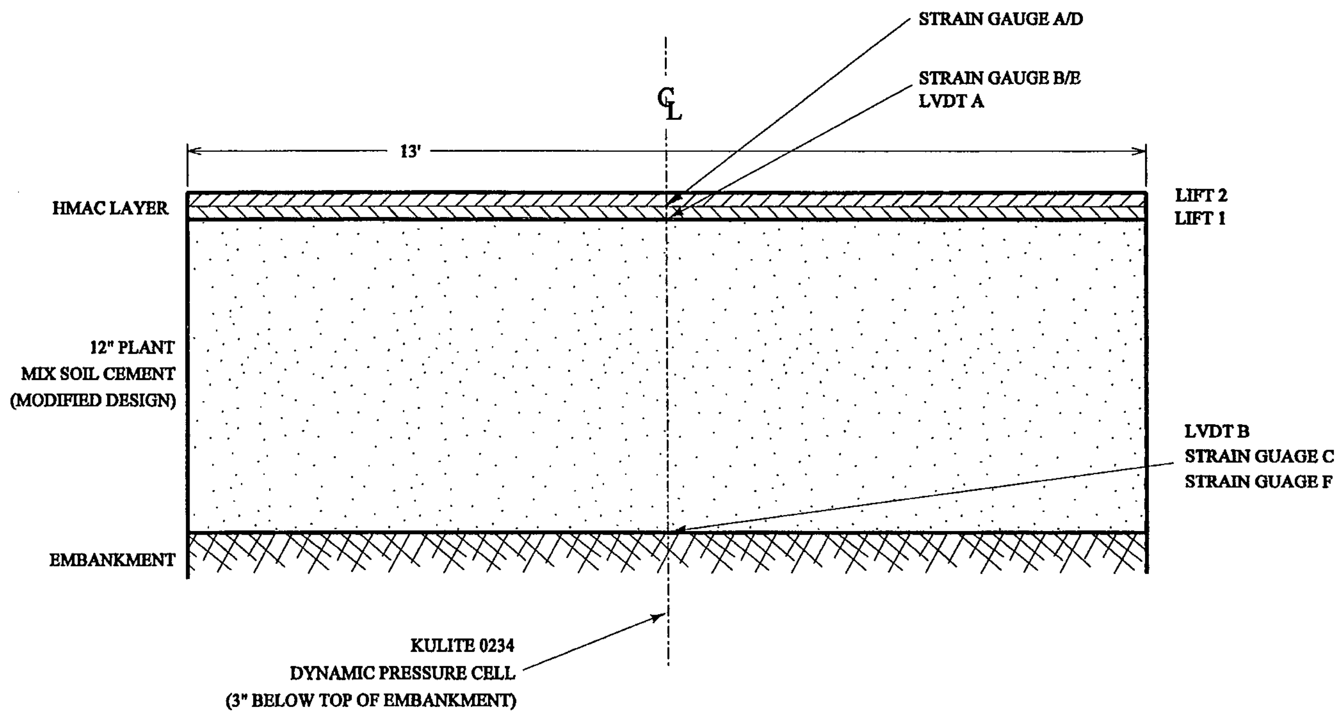


TYPICAL SECTION
LANE - 008
STRAIN GAUGE A/D
STRAIN GAUGE B/E
LVDT A
LIFT 2
LIFT 1
LVDT B
STRAIN GAUGE C
STRAIN GAUGE F
13'
KULITE 0234
DYNAMIC PRESSURE CELL
(3" BELOW TOP OF EMBANKMENT)
HMAC LAYER
8 1/2" IN-PLACE
SOIL CEMENT
(CURRENT DESIGN)
3 1/2" SELECT SOIL
EMBANKMENT

TYPICAL SECTION
LANE - 009



TYPICAL SECTION
LANE - 010



GAUGE LABELING AND LOCATION

LANE	GAUGE NO.	LOCATION/ INTERFACE	FINAL ELEV.	TYPE OF GAUGE
S-002	P1CAT3-1 thru 4	B.C./W.C.	17.49	Micro Meas.
	P1CBT3-1 thru 4	Stone/B.C.	17.41	"
	P1CCT3-1	Subgrade/Stone	16.67	Kyowa
	P1CCT3-2	Subgrade/Stone	16.67	Micro Meas.
	P1CCT3-3	Subgrade/Stone	16.67	Kyowa
	P1CCT3-4	Subgrade/Stone	16.67	Micro Meas.
	P1CLA	Stone/B.C.	17.41	LVDT
	P1CLB	Subgrade/Stone	16.67	LVDT
	P1CDT2-1 thru 4	B.C./W.C.	17.46	Kyowa
	P1CET2-1 thru 4	Stone/B.C.	17.48	"
	P1CFT2-1 thru 4	Subgrade/Stone	16.66	"
	P1CAT1-1 thru 4	B.C./W.C.	17.35	Micro Meas.
	P1CBT1-1 thru 4	Stone/B.C	17.26	"
	P1CCT1-1	Subgrade/Stone	16.58	Kyowa
	P1CCT1-2	"	16.58	Micro Meas.
	P1CCT1-3	"	16.58	Kyowa
	P1CCT1-4	"	16.58	Micro Meas.
	P1CP	Embankment	15.93	Pressure Cell
S-003	P1AAT3-1 thru 4	B.C./W.C.	17.46	Micro Meas.
	P1ABT3-1 thru 4	Subgrade/Stone	17.38	"
	P1ACT3-1	Subgrade/Stone	16.87	Kyowa
	P1ACT3-2	Subgrade/Stone	16.87	Micro Meas.
	P1ACT3-3	Subgrade/Stone	16.87	Kyowa

B.C. - Binder Course HMACW.C. - Wearing Course HMAC

GAUGE LABELING AND LOCATION
(Cont'd)

LANE	GAUGE NO.	LOCATION/ INTERFACE	FINAL ELEV.	TYPE OF GAUGE
S-003	P1ACT3-4	Subgrade/Stone	16.87	Micro Meas.
	P1ALA	B.C./W.C.	17.39	LVDT
	P1ALB	Subrade/Stone	16.88	LVDT
	P1ADT2-1 thru 4	B.C./W.C.	17.38	Kyowa
	P1AET2-1 thru 4	Stone/B.C.	17.36	"
	P1AFT2-1 thru 4	Subgrade/Stone	16.84	"
	P1AAT1-1 thru 4	B.C./W.C.	17.34	Micro Meas.
	P1ABT1-1 thru 4	Stone/B.C.	17.25	"
	P1ACT1-1	Subgrade/Stone	16.72	Kyowa
	P1ACT1-2	"	"	Micro Meas.
	P1ACT1-3	"	"	Kyowa
	P1ACT1-4	"	"	Micro Meas.
	P1AP	Embankment	15.87	Pressure Cell
S-004	P1BAT3-1 thru 4	B.C./W.C.	17.47	Micro Meas.
	P1BBT3-1 thru 4	Stone/B.C.	17.35	"
	P1BCT3-1	S.S. Soil/Stone	17.00	Kyowa
	P1BCT3-2	"	"	Micro Meas.
	P1BCT3-3	"	"	Kyowa
	P1BCT3-4	"	"	Micro Meas.
	P1BCB3-1	"	16.50	Kyowa
	P1BCB3-2	"	"	Micro Meas.
	P1BCB3-3	"	"	Kyowa
	P1BCB3-4	"	"	Micro Meas.

B.C. - Binder CourseW.C. - Wearing CourseS.S. - Stone Stabilized

GAUGE LABELING AND LOCATION
(Cont'd)

LANE	GAUGE NO.	LOCATION/ INTERFACE	FINAL ELEV.	TYPE OF GAUGE
S-004	P1BLA	Stone/B.C.	17.35	LVDT
	P1BLB	Subgrade/S.S.Soil	16.78	LVDT
	P1BDT2-1 thru 4	B.C./W.C.	17.44	Kyowa
	P1BET2-1 thru 4	Stone/B.C.	17.33	"
	P1BFT2-1 thru 4	Subgrade/S.S. Soil	16.98	"
	P1BFB2-1 thru 4	"	16.46	"
	P1BAT1-1 thru 4	B.C./W.C.	17.31	Micro Meas.
	P1BBT1-1 thru 4	Stone/B.C.	17.19	"
	P1BCT1-1	S.S. Soil/Stone	16.88	Kyowa
	P1BCT1-2	"	"	Micro Meas.
	P1BCT1-3	"	"	Kyowa
	P1BCT1-4	"	"	Micro Meas.
	P1BCB1-1	"	16.47	Kyowa
	P1BCB1-2	"	"	Micro Meas.
	P1BCB1-3	"	"	Kyowa
	P1BCB1-4	"	"	Micro Meas.
	P1BP	Embankment	15.85	Pressure Cell
S-005	P2CAT1-1 thru 4	B.C./W.C.	17.48	Micro Meas.
	P2CBT1-1 thru 4	S. C./B.C.	17.38	"
	P2CCT1-1	Subgrade/S. C.	16.65	Kyowa
	P2CCT1-2	"	"	Micro Meas.
	P2CCT1-3	"	"	Kyowa
	P2CCT1-4	"	"	Micro Meas.

B.C. - Binder Course W.C. - Wearing Course S.S. - Stone Stabilized S.C. - Soil Cement

GAUGE LABELING AND LOCATION
(Cont'd)

LANE	GAUGE NO.	LOCATION/ INTERFACE	FINAL ELEV.	TYPE OF GAUGE
S-005	P2CLA	S.C./B.C.	17.38	LVDT
	P2CLB	Subgrade/S.C.	16.61	LVDT
	P2CDT2-1 thru 4	B.C./W.C.	17.48	Kyowa
	P2CET2-1 thru 4	S.C./B.C.	17.36	"
	P2CFT2-1 thru 4	Subgrade/S.C.	16.62	"
	P2CAT3-1 thru 4	B.C./W.C.	17.38	Micro Meas.
	P2CBT3-1 thru 4	S.C./B.C.	17.26	"
	P2CCT3-1	Subgrade/S.C.	16.52	Kyowa
	P2CCT3-2	"	"	Micro Meas.
	P2CCT3-3	"	"	Kyowa
	P2CCT3-4	"	"	Micro Meas.
	P2CP(TOP)	Soil Cement	17.21	Pressure Cell
	P2CP(MID)	Subgrade/S.C.	16.48	Pressure Cell
	P2CP(BOT)	Embankment	15.96	Pressure Cell
S-006	P2AAT1-1 thru 4	B.C./W.C.	17.49	Micro Meas.
	P2ABT1-1 thru 4	S.C./B.C.	17.38	"
	P2ACT1-1	Subgrade/S.C.	16.65	Kyowa
	P2ACT1-2	"	"	Micro Meas.
	P2ACT1-3	"	"	Kyowa
	P2ACT1-4	"	"	Micro Meas.
	P2ALA	S.C./B.C.	17.38	LVDT
	P2ALB	Subgrade/S.C.	16.66	LVDT
	P2ADT2-1 thru 4	B.C./W.C.	17.45	Kyowa

B.C. - Binder Course W.C. - Wearing Course S.S. - Stone Stabilized S.C. - Soil Cement

GAUGE LABELING AND LOCATION
(Cont'd)

LANE	GAUGE NO.	LOCATION/ INTERFACE	FINAL ELEV.	TYPE OF GAUGE
S-006	P2AET2-1 thru 4	S.C./B.C.	17.33	Kyowa
	P2AFT2-1 thru 4	Subgrade/S.C.	16.63	"
	P2AAT3-1 thru 4	B.C./W.C.	17.36	Micro Meas.
	P2ABT3-1 thru 4	S.C./B.C.	17.25	"
	P2ACT3-1	Subgrade/S.C.	16.53	Kyowa
	P2ACT3-2	"	"	Micro Meas.
	P2ACT3-3	"	"	Kyowa
	P2ACT3-4	"	"	Micro Meas.
	P2AP	Embankment	15.93	Pressure Cell
S-007	P2BAT1-1 thru 4	B.C./ W.C.	17.49	Micro Meas.
	P2BBT1-1 thru 4	S.C./B.C.	17.26	"
	P2BCT1-1	Subgrade/S.C.	16.65	Kyowa
	P2BCT1-2	"	"	Micro Meas.
	P2BCT1-3	"	"	Kyowa
	P2BCT1-4	"	"	Micro Meas.
	P2BLA	S.C./B.C.	17.40	LVDT
	P2BLB	Subgrade/S.C.	16.64	LVDT
	P2BDT2-1 thru 4	B.C./W.C.	17.46	Kyowa
	P2BET2-1 thru 4	S.C./B.C.	17.39	"
	P2BFT2-1 thru 4	Subgrade/S.C.	16.63	"
	P2BAT3-1 thru 4	B.C./W.C.	17.40	Micro Meas.
	P2BBT3-1 thru 4	S.C./B.C.	17.40	"
	P2BCT3-1	Subgrade/S.C.	16.51	Kyowa

B.C. - Binder Course W.C. - Wearing Course S.S. - Stone Stabilized S.C. - Soil Cement

GAUGE LABELING AND LOCATION
(Cont'd)

LANE	GAUGE NO.	LOCATION/ INTERFACE	FINAL ELEV.	TYPE OF GAUGE
S-007	P2BCT3-2	Subgrade/S.C.	16.51	Micro Meas.
	P2BCT3-3	"	"	Kyowa
	P2BCT3-4	"	"	Micro Meas.
	P2BP	Embankment	15.96	Pressure Cell
S-008	P3CAT1-1 thru 4	B.C./W.C.	17.51	Micro Meas.
	P3CBT1-1 thru 4	S.C./B.C.	17.39	"
	P3CCT1-1	Subgrade/S.C.	16.66	Kyowa
	P3CCT1-2	"	"	Micro Meas.
	P3CCT1-3	"	"	Kyowa
	P3CCT1-4	"	"	Micro Meas.
	P3CLA	S.C./B.C.	17.40	LVDT
	P3CLB	Subgrade/S.C.	16.70	LVDT
	P3CDT2-1 thru 4	B.C./W.C.	17.49	Kyowa
	P3CET2-1 thru 4	S.C./B.C.	17.37	"
	P3CFT2-1 thru 4	Subgrade/S.C.	16.67	"
	P3CAT3-1 thru 4	B.C./W.C.	17.38	Micro Meas.
	P3CBT3-1 thru 4	S.C./B.C.	17.26	"
	P3CCT3-1	Subgrade/S.C.	16.52	Kyowa
	P3CCT3-2	"	"	Micro Meas.
	P3CCT3-3	"	"	Kyowa
	P3CCT3-4	"	"	Micro Meas.
	P3CP	Embankment	16.04	Pressure Cell

B.C. - Binder Course W.C. - Wearing Course S.S. - Stone Stabilized S.C. - Soil Cement

GAUGE LABELING AND LOCATION
(Cont'd)

LANE	GAUGE NO.	LOCATION/ INTERFACE	FINAL ELEV.	TYPE OF GAUGE
S-009	P3BLA	Stone/B.C.	17.41	LVDT
	P3BLB	S.C./Stone	17.03	LVDT
	P3BLC	Subgrade/S.C.	16.45	LVDT
	P3BDT1-1 thru 4	B.C./W.C.	17.38	Kyowa
	P3BET1-1 thru 4	Stone/B.C.	17.34	"
	P3BFT1-1 thru 4	S.C./Stone	17.01	"
	P3BFB1-1 thru 4	Subgrade/S.C.	16.49	"
	P3BAT2-1 thru 4	B.C./W.C.	17.39	Micro Meas.
	P3BBT2-1 thru 4	Stone/B.C.	17.22	"
	P3BCT2-1	S.C./Stone	16.91	Kyowa
	P3BCT2-2	"	"	Micro Meas.
	P3BCT2-3	"	"	Kyowa
	P3BCT2-4	"	"	Micro Meas.
	P3BCB2-1	Subgrade/S.C.	16.41	Kyowa
	P3BCB2-2	"	"	Micro Meas.
	P3BCB2-3	"	"	Kyowa
	P3BCB2-4	"	"	Micro Meas.
	P3BAT3-1 thru 4	B.C./W.C.	17.49	"
	P3BBT3-1 thru 4	Stone/B.C.	17.21	"
	P3BCT3-1	S.C./Stone	16.89	Kyowa
	P3BCT3-2	"	"	Micro Meas.
	P3BCT3-3	"	"	Kyowa
	P3BCT3-4	"	"	Micro Meas.

B.C. - Binder Course W.C. - Wearing Course S.S. - Stone Stabilized S.C. - Soil Cement

GAUGE LABELING AND LOCATION
(Cont'd)

LANE	GAUGE NO.	LOCATION/ INTERFACE	FINAL ELEV.	TYPE OF GAUGE
S-009	P3BCB3-1	Subgrade/S.C.	16.40	Kyowa
	P3BCB3-2	"	"	Micro Meas.
	P3BCB3-3	"	"	Kyowa
	P3BCB3-4	"	"	Micro Meas.
	P3BBT4-1 thru 4	Stone/B.C.	17.21	Micro Meas.
	P3BCT4-1	S.C./Stone	16.89	Kyowa
	P3BCT4-2	"	"	Micro Meas.
	P3BCT4-3	"	"	Kyowa
	P3BCT4-4	"	"	Micro Meas.
	P3BCB4-1	Subgrade/S.C.	16.43	Kyowa
	P3BCB4-2	"	"	Micro Meas.
	P3BCB4-3	"	"	Kyowa
	P3BCB4-4	"	"	Micro Meas.
	P3BP	Embankment	15.98	Pressure Cell
S-010	P3AAT1-1 thru 4	B.C./W.C.	17.52	Micro Meas.
	P3ABT1-1 thru 4	S.C./B.C.	17.38	"
	P3ACT1-1	Embankment/S.C.	16.20	Kyowa
	P3ACT1-2	"	"	Micro Meas.
	P3ACT1-3	"	"	Kyowa
	P3ACT1-4	"	"	Micro Meas.
	P3ALA	S.C./B.C.	17.39	LVDT
	P3ALB	Embankment/S.C.	16.34	LVDT
	P3ADT2-1 thru 4	B.C./W.C.	17.49	Kyowa

B.C. - Binder Course W.C. - Wearing Course S.S. - Stone Stabilized S.C. - Soil Cement

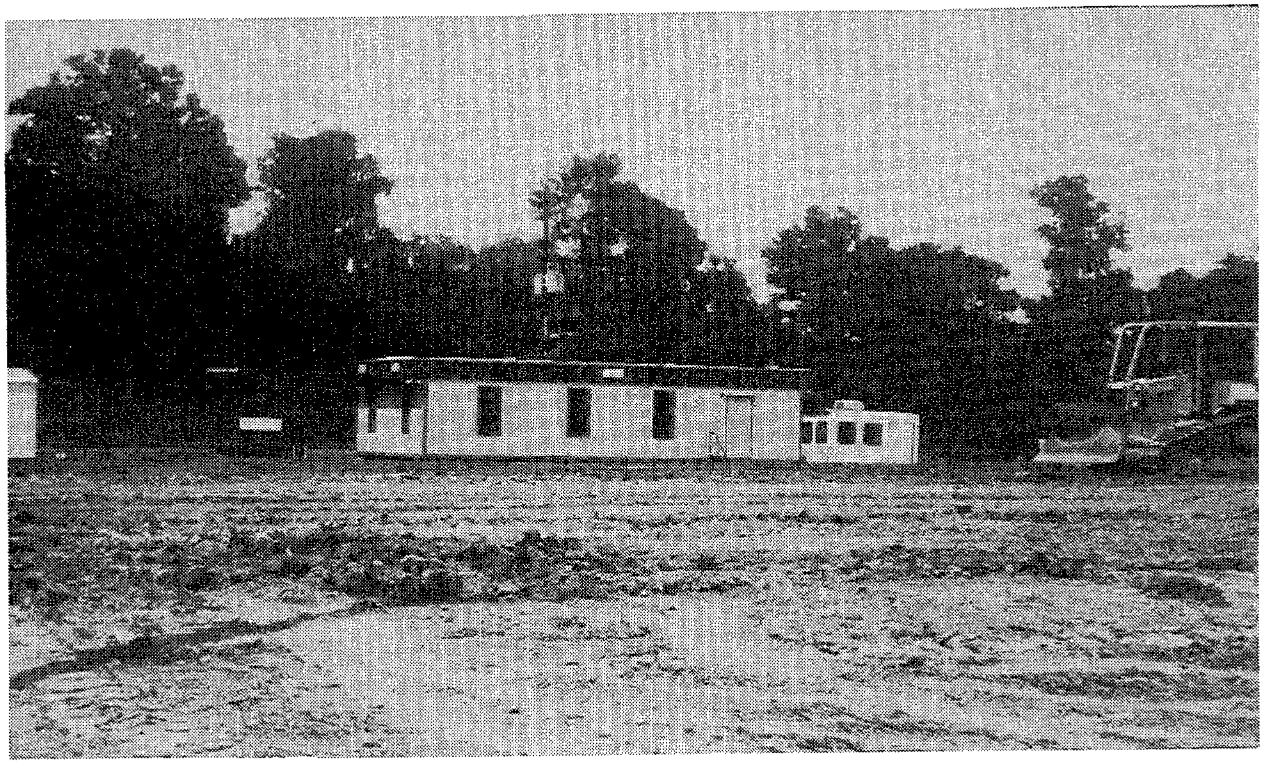
GAUGE LABELING AND LOCATION
(Cont'd)

LANE	GAUGE NO.	LOCATION/ INTERFACE	FINAL ELEV.	TYPE OF GAUGE
S-010	P3AET2-1 thru 4	S.C./B.C.	17.36	Kyowa
	P3AFT2-1 thru 4	Embankment/S.C.	16.32	"
	P3AAT3-1 thru 4	B.C./W.C.	17.36	Micro Meas.
	P3ABT3-1 thru 4	S.C./B.C.	17.24	"
	P3ACT3-1	Embankment/S.C.	16.34	Kyowa
	P3ACT3-2	"	"	Micro Meas.
	P3ACT3-3	"	"	Kyowa
	P3ACT3-4	"	"	Micro Meas.
	P3AP	Embankment	15.94	Pressure Cell

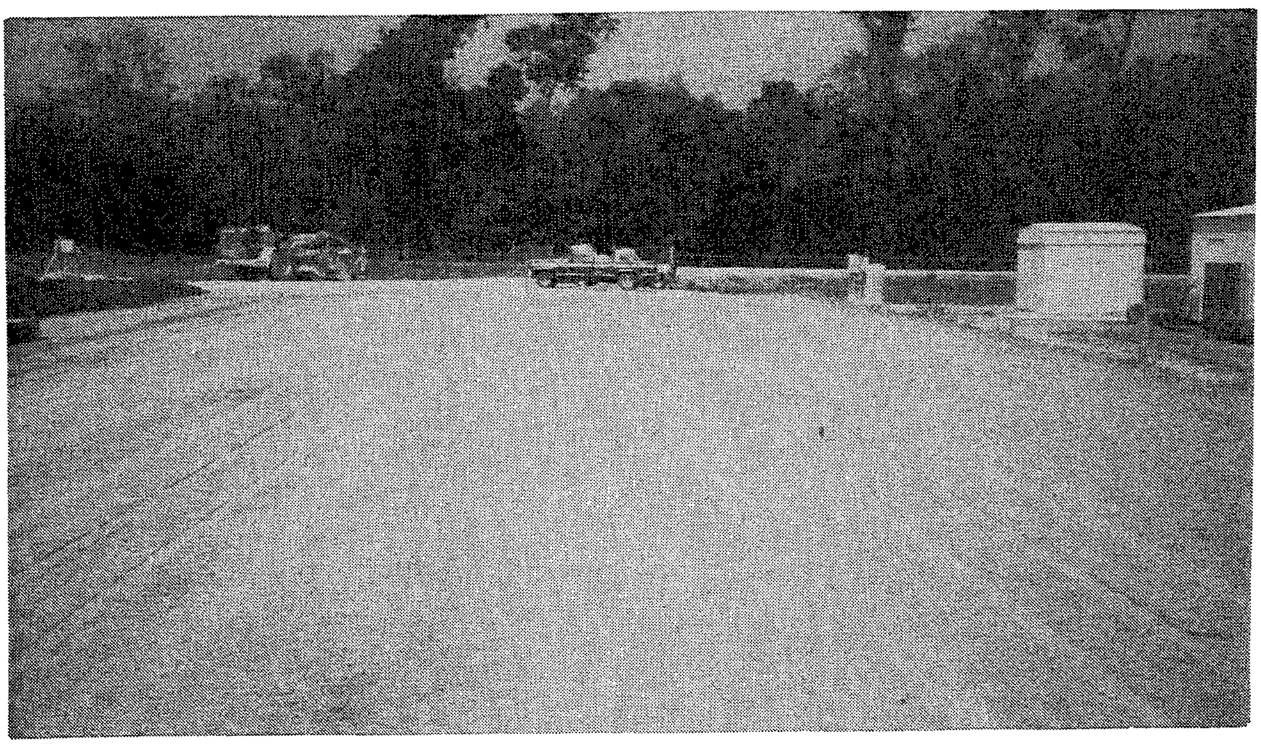
B.C. - Binder Course W.C. - Wearing Course S.S. - Stone Stabilized S.C. - Soil Cement

Appendix C

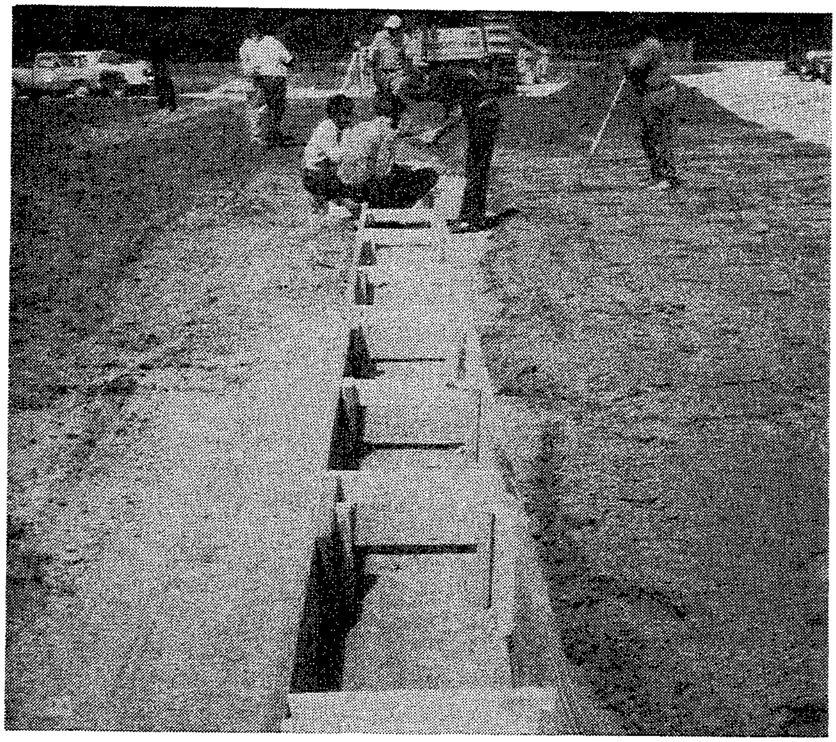
Selected Photographs



Constructing Embankment

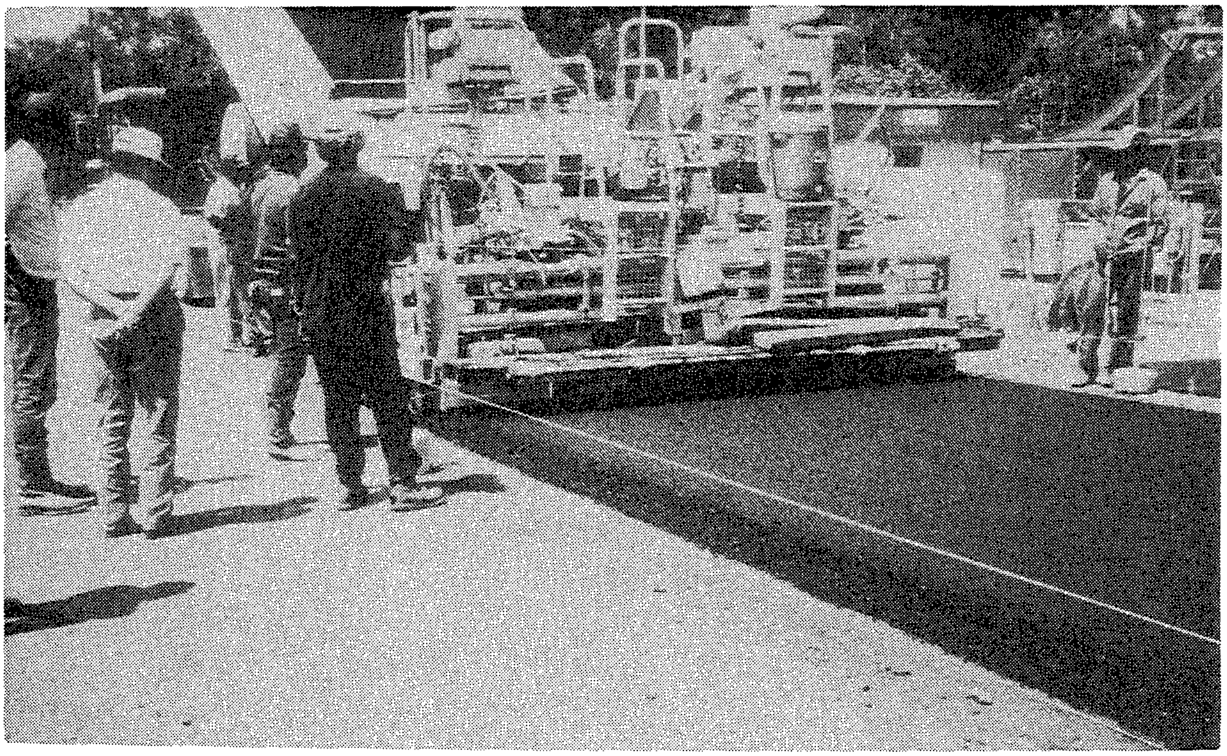


Completed Embankment

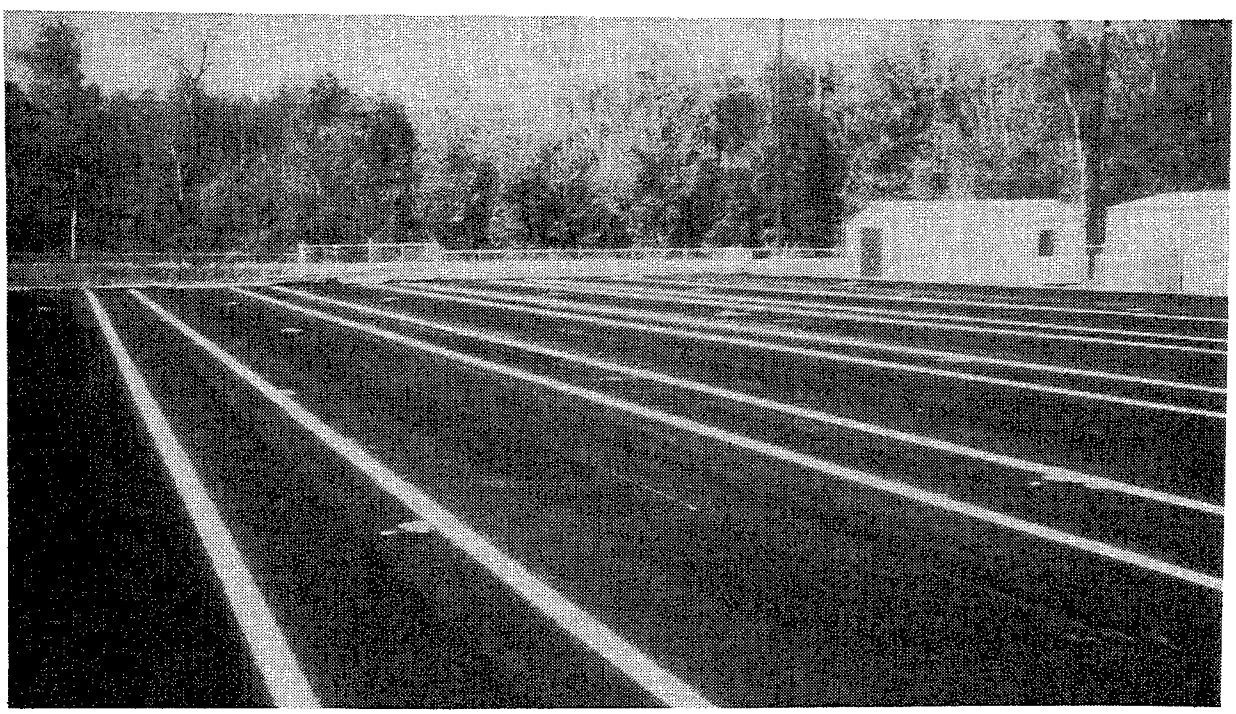


Construction of Base and Formed Block-Out for Instrumentation

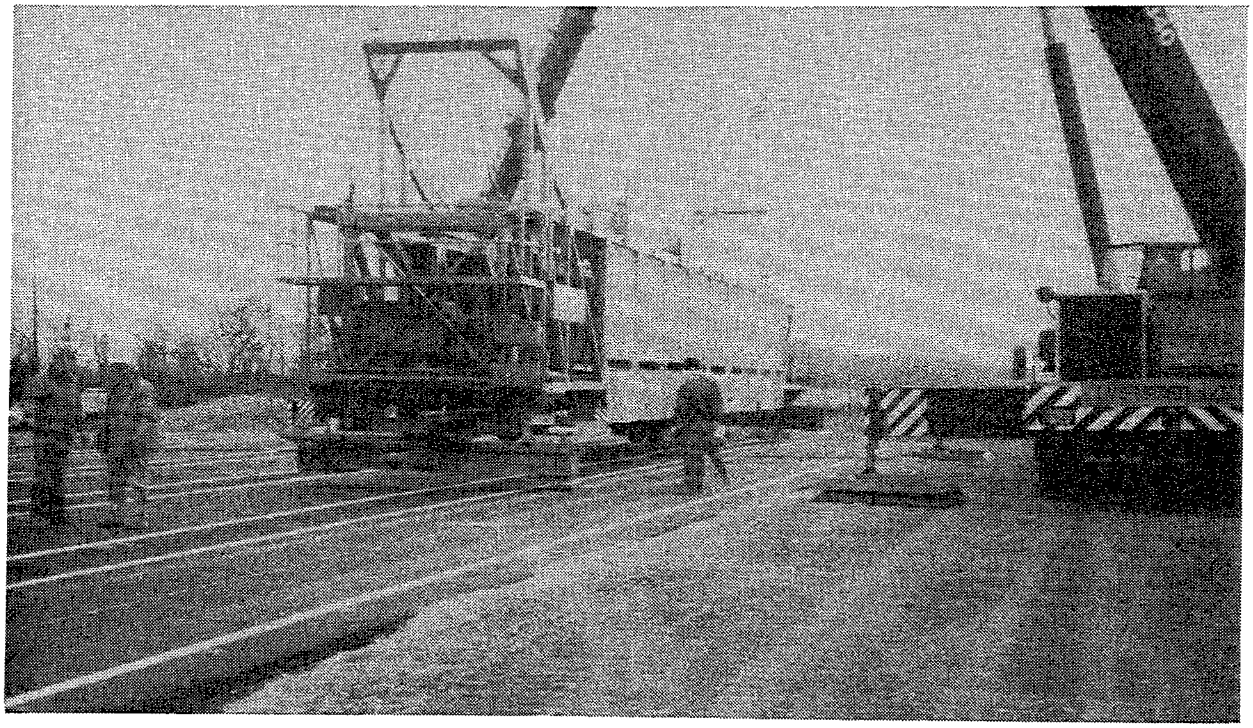
Trimming Base



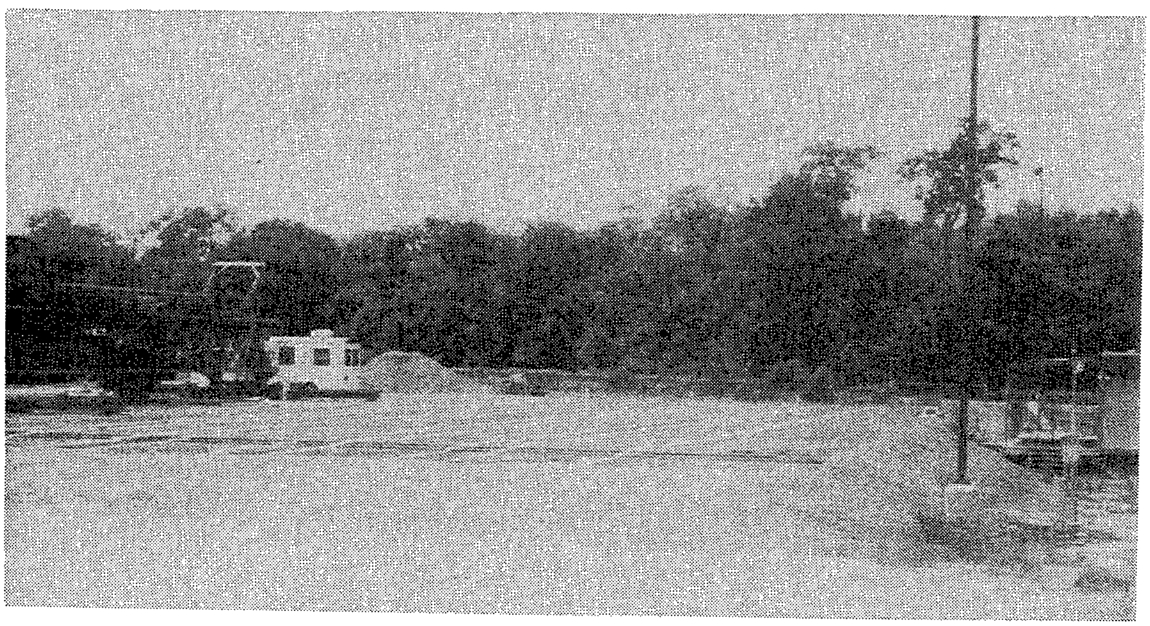
Placing Hot Mix Asphaltic Concrete (HMAC)



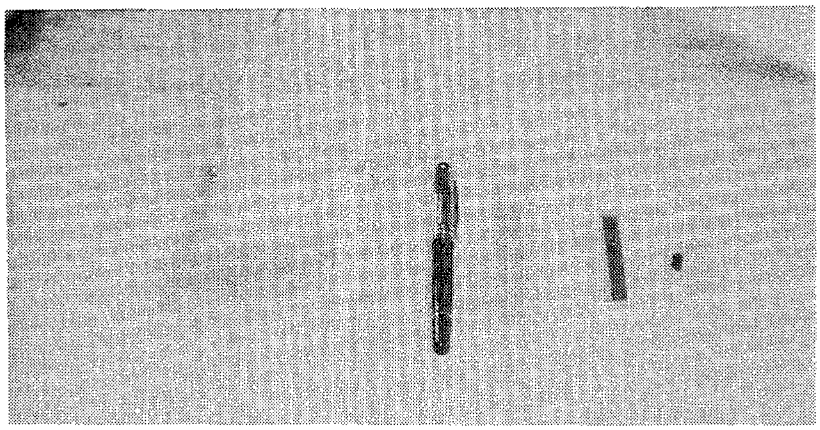
Completed Pavement Including Stripping



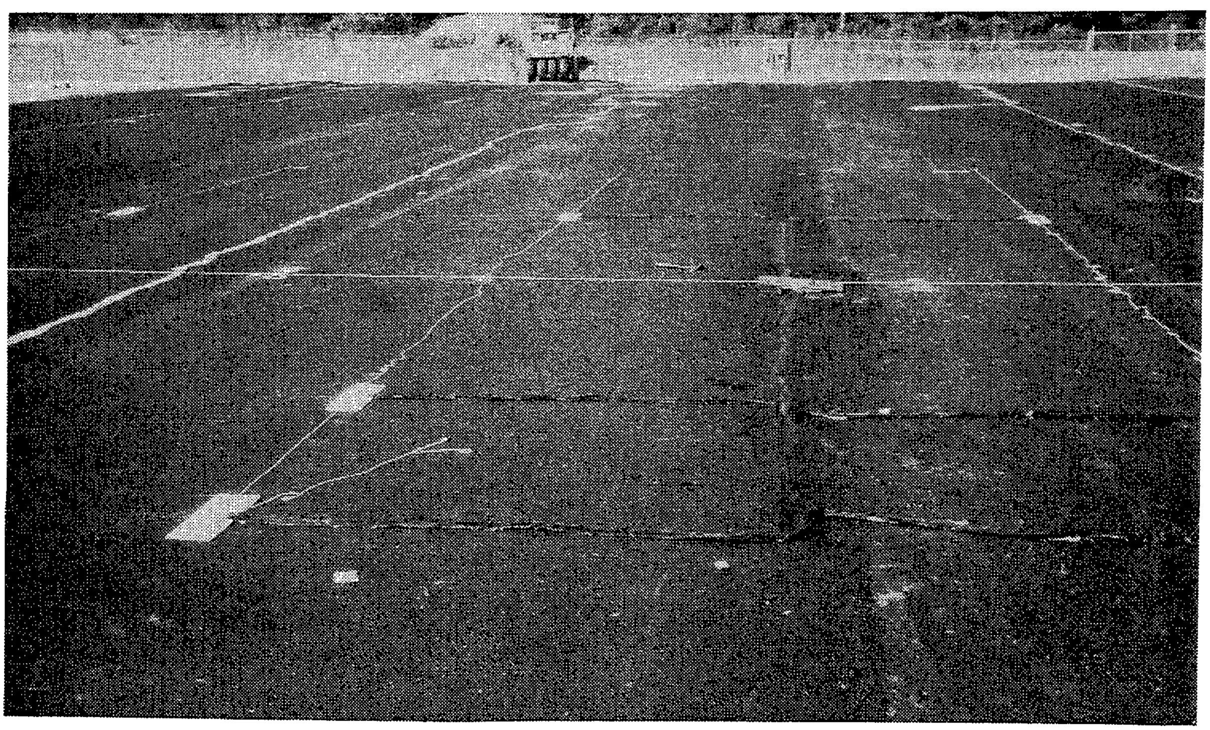
Moving the Accelerated Loading Facility (ALF)



Testing Pavement with ALF



Instrumentation Gauges Used



Placement of Gauges on Top of Base

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